Aviation Week & Space Technology

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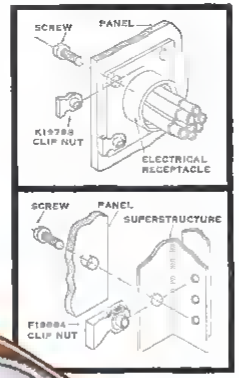
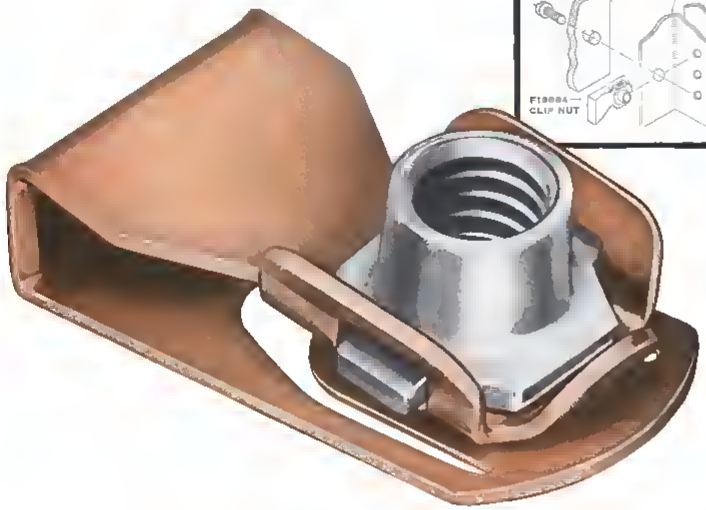
July 15, 1963

SPECIAL REPORT:

Gemini Spacecraft Computer

USAF Thunderbirds Crossover at Paris





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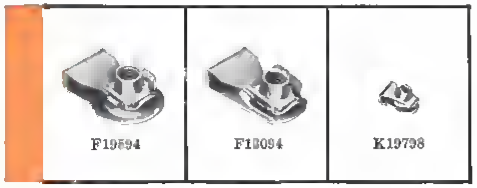

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AEROSPACE CALENDAR

July 18-20—30th Annual International Convention, The Ninety Nines, Skirvin Hotel, Oklahoma City, Okla.

July 23-26—Torpedo Propulsion Conference (Confidential), American Institute of Aeronautics and Astronautics, U. S. Naval Underwater Ordnance Laboratory, Newport, R. I.

July 29-31—Symposium, Toxicity in the Closed Ecological System, Lockheed Research Laboratories, Palo Alto, Calif. Sponsors: U. S. Navy's Special Projects Office; Lockheed Missiles & Space Co.

July 30-Aug. 4—11th Annual Fly-In Convention, Experimental Aircraft Assn., Rockford, Ill.

Aug. 4-9—International Conference and Exhibit on Aerospace Support, Institute of Electrical and Electronics Engineers/American Society of Mechanical Engineers, Park Sheraton Hotel, Washington, D. C.

Aug. 4-16—Sixth Annual Institute on Missile and Space Technology, University of Connecticut, Storrs, Conn.

Aug. 5-9—Eighth Annual Technical Symposium, Society of Photographic Instrumentation Engineers, Ambassador Hotel, Los Angeles, Calif.

Aug. 12-14—Guidance and Control Conference, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

Aug. 14-16—Fifth Biennial Gas Dynamics Symposium, Northwestern University/

(Continued on page 7)

AVIATION WEEK & Space Technology

July 15, 1963

Vol. 79, No. 3

Published weekly with an additional issue in December by McGraw-Hill Publishing Company. James H. McGraw (1860-1948), Founder. See panel below for directions regarding subscriptions or change of address. Executive, Editorial, Circulation and Advertising Offices, McGraw-Hill Building, 330 West 42nd Street, New York 36, N. Y. Printed at Albany, N. Y. OFFICERS OF THE PUBLICATIONS DIVISION: Shelton Fisher, President, Vice Presidents: George H. Bennett, Jr., Operations; John R. Callaham, Editorial; Ervin E. DeGraf, Circulation; Donald C. McGraw, Jr., Advertising Sales; Angelo R. Venezian, Marketing. OFFICERS OF THE CORPORATION: Donald C. McGraw, President; Hugh J. Kelly, Gerry L. Waddell, Executive Vice Presidents; L. Keith Goodrich, Executive Vice President and Treasurer; John J. Cosgo, Vice President and Secretary.

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Available to Government officials and military officers professionally concerned with aerospace via the Federal Supply Schedule. Send requisition (showing subscriber's title or rank) direct to Circulation Manager, Aviation Week, 330 West 42nd Street, New York 36, New York. Specify FSS Stock Requisition Number 7300-92-810. Index No. 355. FSC Group 76, Part III.

Single copies 75¢. Subscription rates—United States and possessions $7 one year. Canada $8 one year. All other countries $10 one year.

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Second class postage paid at Albany, N. Y. Printed in U. S. A. Title registered in U. S. Patent Office.

Subscribers: Send correspondence and changes of address to Fulfillment Manager, Aviation Week, P. O. Box 430, Hightstown, N. J. Subscribers should notify Fulfillment Manager promptly of any change of address, giving old as well as new address (including postal zone number). Please report address label if possible. Allow one month for change to become effective.

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AEROSPACE CALENDAR

(Continued from page 5)

American Institute of Aeronautics and Astronautics, Evanston, Ill.

Aug. 19-21 — Astrodynamics Conference, American Institute of Aeronautics and Astronautics, Yale University, New Haven.

Aug. 19-21—1963 Cryogenic Engineering Conference, Boulder, Colo. Sponsors: University of Colorado, NBS Cryogenic Engineering Laboratory.

Aug. 20-23—1963 Western Electronic Show and Convention (WESCON), Cow Palace, San Francisco, Calif.

Aug. 26-28—Simulation for Aerospace Flight Conference, American Institute of Aeronautics and Astronautics, Deshler-Hilton Hotel, Columbus, Ohio.

Aug. 26-28—Conference on Physics of Entry into Planetary Atmospheres, American Institute of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge, Mass.

Sept. 8-11—International Symposium on High Temperature Technology, Asilomar, Calif. Sponsor: Stanford Research Institute.

Sept. 8-11—Annual Meeting, Air Industries Assn. of Canada, Manoir Richelieu, Murray Bay, Quebec.

Sept. 9-11—Seventh National Convention on Military Electronics, Institute of Electrical and Electronics Engineers, Shoreham Hotel, Washington, D.C.

Sept. 9-12—13th Annual Instrument-Automation Conference & Exhibit, Instrument Society of America, McCormick Place, Chicago, Ill.

Sept. 10-12—National Symposium on Space Rendezvous, Rescue and Recovery, Edwards AFB, Calif. Sponsors: American Astronautical Society, Air Force Flight Test Center.

Sept. 10-12—New York University's Third Annual Air Transport Conference, Washington Square Center, New York, N.Y.

Sept. 11-15—17th Annual National Convention & Aerospace Panorama, Air Force Assn., Sheraton Park and Shoreham Hotels, Washington, D.C.

Sept. 16-18—International Aviation Research and Development Symposium, Atlantic City, N.J. Sponsor: Federal Aviation Agency.

Sept. 18-19—1963 Airwork Operations and Maintenance Symposium, Millville, N.J.

Sept. 20-29—Ninth Annual Houston International Trade & Travel Fair, Sam Houston Coliseum, Houston, Tex.

Sept. 23-27—National Aeronautic and Space Engineering and Manufacturing Meeting and Display, Society of Automotive Engineers, Ambassador Hotel, Los Angeles.

Sept. 23-27 — International Telemetering Conference, Savoy Place, London, England. Sponsors: Institution of Electrical Engineers (London), American Institute of Aeronautics and Astronautics, Institute of Electrical and Electronics Engineers, Instrument Society of America.

Sept. 25-26—Second Annual Symposium on the Physics of Failure in Electronics, Chicago, Ill. Sponsors: Rome Air Development Center, Armour Research Foundation.

Sept. 26-Oct. 1—14th Congress, International Astronautical Federation, Paris.

(Continued on page 9)

PROBLEMATICAL RECREATIONS 179

Furbisher lives in Canoga Acres and works in Beverly Flats. LaRouche lives in Beverly Flats and works in Canoga Acres. They usually leave their respective homes at the same time, and pass each other at Sam's Hamburger Shack. (Furbisher drives twice as fast as LaRouche.) On a day when Furbisher's wife Formica spoiled the eggs and he left 5 minutes late, they passed each other at the gas station, two miles from Sam's. How fast do they drive? — *Contributed*

ANSWER TO LAST WEEK'S PROBLEM: $R = 18$, Area $= 1296\pi$, Volume $= 7776\pi$

AEROSPACE CALENDAR

(Continued from page 7)

Sept. 27-28—Society of Experimental Test Pilots Seventh Annual Report to the Aerospace Profession and Awards Banquet Beverly Hilton Hotel Beverly Hills

Sept 30-Oct 1—Manned Interplanetary Exploration Meeting American Institute of Aeronautics and Astronautics Cabana Motor Hotel, Palo Alto, Calif

Sept 30-Oct. 2—Canadian Electronics Conference, Institute of Electrical and Electronics Engineers, Exhibition Park, Toronto, Canada

Oct. 1-3—Eighth National Symposium on Space Electronics, Institute of Electrical and Electronics Engineers Fontainbleu Hotel Miami Beach Fla

Oct 1-3—National Aerospace Nuclear Safety Topical Meeting American Nuclear Society Albuquerque N M Co-sponsors Los Alamos Scientific Laboratory, Al C Albuquerque Operations Office AF Special Weapons Center, AF Directorate of Nuclear Safety, Sandia Corp , University of New Mexico

Oct 2 4—National Assn of Air Traffic Specialists Sheraton-Oklahoma Hotel Oklahoma City Okla

Oct 7-9—Ninth National Communications Symposium, Institute of Electrical and Electronics Engineers Hotel Utica Utica

Oct. 7-11—International Air Transport Assn 19th Annual General Meeting, Rome, Italy

Oct 8-10—10th Annual Air Force Science and Engineering Symposium Air Force Academy, Colo Sponsors Office of Aerospace Research, AFSC

Oct 9-11—21st Annual Aerospace Electrical/Electronics Conference, Aerospace Electrical Society, Pan Pacific Auditorium, Los Angeles Calif

Oct 13-17—16th Annual Meeting and Conference Airport Operators Council, Roosevelt Hotel New Orleans La

Oct 14 16—Eighth Annual Exposition and Symposium, Air Traffic Control Assn Statler Hilton Hotel Dallas Tex

Oct. 15 18—Eighth Symposium on Ballistic Missile and Space Technology Naval Training Center, San Diego Calif Sponsors AF Space Systems Div ; AF Ballistic Systems Div , Aerospace Corp

Oct 16-18—Fourth National Vacuum Symposium, American Vacuum Society, Statler Hilton Hotel, Boston Mass

Oct 17-18, Oct 21 22—Ninth Anglo American Conference, American Institute of Aeronautics and Astronautics Canadian Aeronautics and Space Institute Royal Aeronautical Society Massachusetts Institute of Technology Cambridge, Mass (Oct 17 18) Queen Elizabeth Hotel Montreal, Canada (Oct 21 22)

Oct 21 23—Tenth Annual East Coast Conference on Aerospace and Navigational Electronics, Institute of Electrical and Electronics Engineers, Emerson Hotel, Baltimore Md

Oct 22 24—Conference on Expandable Structures National Cash Register Co's Sugar Camp, Dayton, Ohio Sponsor Aeronautical Systems Division's Propulsion and Flight Dynamics Laboratories

Oct 23-25—Annual Meeting Human Factors Society, Ricky's Hyatt House Palo Alto Calif

FRUEHAUF'S ENGINEERING SKILL TRIMS WEIGHT, ADDS STRENGTH IN PRODUCING TITAN TRANSTAINER

Shown loading a Titan I ICBM aboard a giant MATS-133B transport at Denver's Lowry Air Force Base is one of a number of transtainers designed and built by Fruehauf. Second view of the unit unloaded reveals its general construction features

Fruehauf's vast capability and years of experience as a producer of hundreds of units for the military—on both prime and subcontracts—enabled it to furnish a quantity of these transtainers economically and on a tight schedule They are of aircraft structural design to keep weight down and their amazing strength was proven in road-tests at 50 MPH with a 50% overload. They are towable from either end.

Fruehauf has the largest engineering and manufacturing facilities in the truck-trailer industry, produces shipping containers and truck bodies in addition to trailers Its capability as a designer and producer of military equipment is outlined in a booklet titled "Fruehauf G S E.—Military and Missile." Send for your free copy today.

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defeated for high speed search, direct recording to 300 KC phase and amplitude equalized, FM recording to 20 KC phase equalized, and all solid-state electronics throughout There's nothing around that will measure up to the FR-1300 for performance per pound And one more thing Ampex precision and reliability through and through For data write Ampex Corp., Redwood City, Calif Worldwide sales, service.

We copied the Caravelle, too!

Seems almost everybody is copying the Caravelle these days. Why not? The basic design makes so much sense. Engines mounted aft where passengers hardly hear them—mounted externally for easy access and structural simplicity—and a clean, uncluttered wing.

We copied all these features, too, when we built the new, faster, more economical Super Caravelle, and we were able to copy something that nobody else could—dependability proven in four years of airline service. We were able to copy this exactly because another feature of the basic design was its potential for development—the ability to install new, more powerful engines without major structural, system or aerodynamic changes.

We lengthened the fuselage here to accommodate more happy passengers; we changed the wing a little there to make the short field capabilities even better, and we installed more powerful and economical fan jet engines. The Super Caravelle is as new an airplane as anything on the market when it comes to performance, economy, and passenger appeal and it's as dependable and trouble-free as the one we copied.

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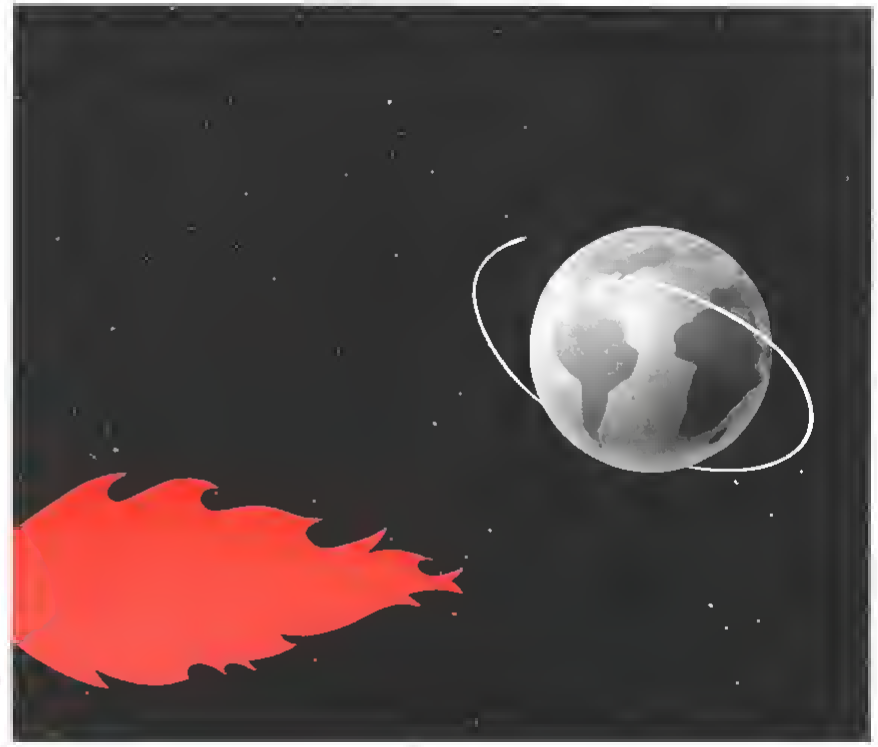

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Aviation Week & Space Technology

Volume 79
Number 3

July 15, 1963

CONTENTS

COVER: Two North American F-100 Super Sabres of the U.S. Air Force's Thunderbirds jet aerobatic team cross within approximately 10 ft. of each other with one aircraft inverted during the team's demonstration at the recent Paris Air Show (AW June 24, p. 27). For additional photos of Paris demonstrations by jet aerobatic teams, see pp. 52-57.

PICTURE CREDITS
Cover—Ron Appelbe 27—Republic Aviation Corp. 30 31—Saab 37 82—Bristol Siddeley Engines Ltd. 41 47—Boeing 33 43 52 53 54 55 56 57 73—Ron Appelbe 58 59 81 83 87—IBM 69—Aviation Week 75 79—Breguet 87—Aerospace Corp. 89—Martin Co. 91—Emerson Electric; 92—Westinghouse.

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More Supersonics

The competitive pressures in the supersonic transport field are beginning to build up to explosive force. We predict that by the time the 19th annual general meeting of the International Air Transport Assn. convenes next October in Rome, there will be ample cause for some of the delegates to fulminate over the "rash panic buying" in the supersonic equipment field, just as they have been doing for the past few years over the subsonic jet picture. We think their wailings will have about the same effect on supersonics as they had on the initial round of subsonic equipment buying—nil.

The airlines operating in sharply competitive markets where only a sharp edge of efficiency can keep them in the black, will certainly seize on the first proven supersonic jet transports, whether they are in the Mach 2 or Mach 3 speed range. Juan Trippe's recent indication (AW June 10, p. 40) that Pan American World Airways will take the plunge is already having significant effects among his competitors. Most of them will have to follow his lead within the next few months, whether they really want to jump into supersonics or not, simply to maintain their competitive position and avoid being dubbed as "obsolescing" airlines.

Concorde Lead

Meanwhile, it is worth surveying the international competition in the race to capture this market to determine if there are any significant trends among the competitors that may foreshadow a winner. The Anglo-French Concorde Mach 2.2 project is off to a good start, has avoided many of the standard European pitfalls and must be considered the current leader. The British and French technicians face many problems in bringing their aircraft to operational status. However, they are working well within the current state of the aeronautical art where the French, particularly, are gaining considerable Mach 2 delta flight experience with their Mirage series aircraft. We expect their biggest problem will be simply the slower European pace and the lack of sufficient research and development facilities on the scale required for an effort of this magnitude. Europeans tend to underestimate U.S. speed in its development pace once technical goals have been firmly set and managerial and governmental support is determined. They should watch the current race between the de Havilland Trident and the Boeing 727 for an example of what we mean by this.

The Soviet Union plans to compete in the supersonic transport era, but we tend to discount the significance of its effort in any international competitive sense. The Soviets' jump into the jet transport age has been a remarkable achievement for their technicians and industry. But they have not been able to maintain much stature when stacked against Western competition. None of the Soviet jet transports has proved sufficiently economical in airline operations to be attractive even to other countries with Communist governments. The Chinese, Poles and Yugoslavs have all purchased transports of Western manufacture when possible. Even the African nations who exchanged their peanut crops for Ilyushin and Antonov transports have found the Soviet aircraft uneconomical in competitive markets.

Soviet Handicap

Much of the Soviet deficiencies in this regard can be credited to the rigid security vacuum in which their technicians worked for the past 30 years. This left them rather naive in some areas where continuous competitive contact with the West would have educated them thoroughly. According to the latest intelligence reaching us from Moscow, Sergei Ilyushin is heading the Soviet supersonic transport program and has settled on a large delta wing design with four huge turbojets mounted in twin nacelles under the trailing edge of the wing. His general plan is similar to the Anglo-French Concorde design. This should come as no surprise to those who have noted prior evidence of Mr. Ilyushin's regard for British design in the striking resemblance between his Il-62 and the British Aircraft Corp. VC-10. The Soviet design is also aimed at the Mach 2 speed range.

We doubt that the Soviet supersonic transport will have much competitive impact outside the pages of Pravda and Izvestia. But we are also certain that it will eventually appear on the Soviet international routes in the livery of Aeroflot as the very best effort the Russian aircraft industry can produce.

The biggest mystery in this three-cornered competition is still the United States. If this country fixes some firm goals within the next few months and gives its technicians a clear track without too many political obstacles, we think the other competitors will be surprised at the pace with which the U.S. development program will move, and the European lead may evaporate fast.

However, it is possible to continue the debate, restudy and political log-rolling past the point where even the finest technical resources in the world can ever regain the critical lost time. This is the knife edge on which the U.S. supersonic transport prospects are now balancing.

—Robert Hotz

WHO'S WHERE

In the Front Office

Raymond E. Jacobson, vice president, Maxson Electronics Corp. and president of the company's Electronics Div., succeeding **Charles S. Hays**, resigned.

Stanley K. Weissberg, vice president and technical director, Spacelabs, Inc., Van Nuys, Calif.

Peter G. Peterson, president, Bell & Howell Co.

Carl F. Amisch, chief of Investigations Div., Federal Aviation Agency's Office of Compliance and Security.

John H. Cumby, vice president, Republic National Bond; and **George M. Reynolds**, Winrock Enterprises, Inc., elected to SPACE Corp. board of directors.

Sanford Davis, assistant division manager, Garrett Air Cruisers Div. He will continue as production manager.

Elmo Roper and **Bryan Steele**, elected to board of directors, The Nylok Corp., Paramus, N. J.

Barry B. Willis, vice president-manufacturing engineering and sales, Western Div., Purolator Products, Inc.

Wayne Rosenkrans, senior vice president-operations, Jeppesen & Co., Denver, Colo.; and **John Dickinson**, vice president-government affairs. Also, **T. W. McKnight**, vice president on the executive staff; **Robert P. Keller**, vice president-marketing; **William A. Prescott**, vice president-general aviation sales; **Edmund H. Moerer**, controller; **Douglas Rabb**, personnel manager.

Ross D. Stevens, vice president-finance and treasurer, Electro Instruments, Inc., San Diego, Calif.

James H. Hollyer, executive vice president, Robinson Vibrashock Div. of Robinson Technical Products, Inc., Teterboro, N. J. Also, **H. Erich Nietsch**, vice president-sales and project development; **W. A. Keetch**, vice president-product engineering and technical operations; **C. R. Davis**, vice president-Western Region (Santa Monica, Calif.) and design engineering.

Raymond S. Fries, vice president, Honeywell's Brown Instruments Div., Philadelphia, Pa., he continues as the general manager.

Fred K. Gnest, director, Program Operations, Mobile Mid-Range Ballistic Missile Program (MMRBM), San Bernardino, (Calif.) Operations of Aerospace Corp. Also, **Dr. George V. Nolde**, senior staff engineer to the director, Electronics Systems Office, MMRBM; **Jason W. Capps**, director-analysis and integration, MMRBM.

William Frontz, manager-research and development, Weston Hydraulics Ltd., a subsidiary of Borg-Warner.

Horace G. McDonnell, general manager, Vermistat Div., Perkin-Elmer Corp.

Honors and Elections

Maj. Robert M. White, USAF, has been awarded the National Geographic Society's Gen. Thomas D. White Space Trophy for his flights in the North American X-15 research aircraft (AW June 10, p. 38).

Capt. Harry F. Clark, Trans World Airlines, elected Region 1 vice president, Air Line Pilots Assn.

INDUSTRY OBSERVER

► Firms with potential in such special categories as guidance and control were briefed last week by North American Aviation's Space and Information Systems Div. for participation in a six-month study on adapting Apollo as a logistics vehicle for a national space station. The division has a limited-fund contract for the study with the National Aeronautics and Space Administration. Participation of other companies will be on a non-contractual, unfunded basis.

► **India's Tata committee is showing a preference for the de Havilland Caribou 2, under development in Canada with the General Electric T64 as the powerplant, to meet India's requirement for a military transport with improved high-altitude takeoff and landing performance. The committee, headed by J. R. D. Tata, chairman of Air-India International, was formed to coordinate India's aviation development projects. The committee's preference for the Caribou is largely responsible for the slowdown in India's program to build the Avro 748 twin-turboprop transport under license. It is unlikely India will drop the Avro project, however, because of the potential civil demand in Asian markets.**

► Proposals will be submitted next week to USAF's Aeronautical Systems Div. for a study encompassing takeoff and landing systems for future high-performance aircraft and manned recoverable boosters that will land horizontally. State-of-the-art and projected requirements for hypersonic and super-orbital vehicles will be considered. Systems must be suitable for repeated takeoffs and landings on runways now accommodating B-52 aircraft.

► **Aerojet-General Corp. will attempt to eliminate vibration in the Martin Titan 2 booster, scheduled to be the launch vehicle for Gemini flights. At NASA's request, Air Force will award the firm a contract for redesign of the turbo-pump system, suspected as the prime cause of vibration.**

► Equipment scheduled for use in Defense Dept.'s airborne national command post is being tested in flights aboard a Boeing KC-135 under Project Night Watch. Command post may become part of a national military command system that would ensure maintenance of civilian and military authority in event of attack.

► **Army will provide $250,000 to advance development of the Wasp 40-mm anti-personnel spin rocket by Emerson Electric's Electronics and Space Div., which was supporting the effort with company funds. Wasp is intended for use by helicopters, limited-warfare aircraft and ground troops.**

► Air Force's Aeronautical Systems Div. has recommended that Hoffman APG-57 ranging radar be installed on the Northrop Norair Div.'s F-5A fighters slated for the military assistance program. Hoffman equipment, selected for its economic feasibility, must be modified to fit the aircraft.

► **McDonnell Aircraft Corp. has an advanced design for a Mach 3-4 tactical fighter that will fit USAF's Aeronautical Systems Div. Advanced Development Objective 12 for a fighter capable of speeds greater than those of the F-111 (AW June 17, p. 22).**

► Air Force plans to equip airmen with small, personal crash locator beacons that will broadcast line-of-sight signal tones in the 243-mc. UHF military distress frequency band to facilitate searches for accident survivors. Rescue aircraft would use automatic direction finders to home on downed airmen. Aeronautical Systems Div. is procuring about 28,000 of these beacons, designated URC-21, and about 14,000 larger URC-10 transceivers.

► **Navy's Tartar, Terrier and Talos surface-to-air missiles made a better showing during a recent demonstration before President Kennedy than they did in a similar situation last year, when they failed to knock a drone from the sky. Navy played it safe in the recent demonstration off the U. S. West Coast by firing two or more missiles at a time, thereby scoring 100% hits on all targets.**

Washington Roundup

New Briefing Control

Defense Dept within the next few weeks will issue new rules designed to tighten civilian control over briefings the military services give industry on future projects.

Pentagon spokesmen declare they are merely trying to bring order into the often chaotic briefing procedures of the Air Force, Navy and Army. But some military leaders see the rules as a further tightening of their check rein by Defense Secretary Robert S. McNamara.

Staff of the Defense Industry Advisory Council initiated the move with the approval of Deputy Defense Secretary Roswell L. Gilpatric. Now Dr. Harold Brown, director of defense research and engineering, has the job of implementing the new briefing format. He is expected to issue rules to the services before the end of August, perhaps as early as this month.

Backers of the new rules complain that the services in the past sometimes have misled industry by indicating definite interest in far-out proposals which had no chance of being approved at the top. This they argue, wasted industry's time and money on studies and proposals. Also, the individual services have not coordinated their briefings very well or made them as informative as they should be, the reformists contend.

The new rules will require the services to get approval from DDR&E before calling industry in to discuss their future needs. As now envisioned, the rules on briefings would apply only to exploratory projects—not specific items near the procurement stage. Defense Dept. also hopes the rules will ensure that the services brief the pertinent segment of industry, not just a few favored firms. Representatives of the defense secretary are expected to attend most the briefings under the new format. "We've got to get a handle on what they're doing," one defense official said in justifying the reform.

Webb's New Approach

Blasting the House space committee for sharply cutting his budget marks a radical change in tactics for Administrator James E. Webb of the National Aeronautics and Space Administration (see p. 29).

Webb heretofore has prided himself on working his will on Congress through steady but quiet consultation with the leaders. Last week he resorted to frontal assault, charging the committee's authorization bill—which sets ceilings for appropriations—amounted to "an inadequate level of support."

But the bigger battle is just ahead when legislation actually appropriating the money to NASA is voted. Chairman Clarence Cannon of the House Appropriations Committee has so little enthusiasm for the space program that he again will insist on deep cuts in the budget. Last year his committee cut the NASA budget $143 million, a slash $27 million greater than that recommended in the House authorization bill.

New JFK Helicopters

Despite some congressional opposition, President Kennedy soon will have two additional Sikorsky VH-3A helicopters for the White House fleet. The additions will bring the fleet total to 10 VH-3As: five from the Army and five from the Marine Corps. The new aircraft will replace two VH-34s. The VH-3As will cost $1.125 million each and be paid for through reprogramming of Army and Navy procurement funds. Opposition in Congress, which must approve large reprogramming requests, centered on whether the two VH-3As were really needed. President Kennedy wrote a personal letter requesting the helicopters. Part of the justification was that the helicopters might be needed in an emergency.

Korth's Woes Mount

Navy Secretary Fred Korth is swimming in a sea of troubles these days. His military leaders resent the part he played in the firing of Adm. George Anderson as chief of naval operations. His testimony before the Senate subcommittee investigating the F-111 (TFX) contract award irked Chairman John L. McClellan, and he is in for a continuing, painful Senate examination to see if his activities as secretary violated any conflict-of-interest rules.

Korth was president of a bank in Ft. Worth, Tex., that had dealings with General Dynamics, winner of the F-111 contract. He told the Senate subcommittee he stayed objective and did not take a leading role in the F-111 deliberations to avoid any appearance of favoring his home town contractor. But after saying that, Korth told the subcommittee in great detail the technical factors which figured in his preference for General Dynamics.

Another conflict-of-interest possibility that some senators want to explore is what part Korth played in the award of the X-22A contract to Bell after the Navy professionals had recommended Douglas. Korth had been a director of Bell. Gilpatric recently told a Senate subcommittee that he asked Korth about Bell's management before awarding the X-22A contract (AW June 24, p. 36).

The reason that NASA's launch of an Air Force payload with a Scout booster from Wallops Island, Va., June 28 was kept so secret was that the USAF and space agency press officers specially assigned to the detail each thought the other was informing the press.

—Washington Staff

Budget Unit Implementing Howze Plans

Special group's study of mobility requirements will lead to larger Fiscal 1965 aircraft, missile requests.

By Larry Booda

Washington—Substantial increase in the Army's Fiscal 1965 budget request for aircraft and light tactical missiles will result from the actions of a special working group that is analyzing what aircraft, weapons and personnel are needed to increase the Army's mobility.

The group in effect is translating recommendations by last year's Tactical Mobility Requirements Board into a five year program, of which Fiscal 1965 is the first year. Funds requested for aircraft procurement will pass the $500 million mark for the first time. Emphasis on helicopters will continue.

Lt. Gen. Dwight E. Beach, Army's chief of research and development, formed the group last month to supplement the regular headquarters budgeting and programing offices and began the task unannounced. The group's work is expected to last until the latter part of August, when initial Fiscal 1965 budget submissions are due in the office of the secretary of defense.

Maj. Gen. Chifton F. Von Kann, former director of Army Aviation, is deputy to Gen. Beach. His current post is commanding general of the First Calvary Division in Korea. He was a member of the Howze Board, named for its chairman, Lt. Gen. Hamilton H. Howze, which made the original recommendations on how to improve Army mobility (AW June 25, 1962, p. 26).

The Fiscal 1964 budget now being considered by Congress does not take into account the recommendations of the Howze Board. It is based on the present Army organization—20 regular divisions plus two Reorganization Objective Army Divisions (ROAD).

Gen. Beach and his group will have to set aircraft, armor and ground lift fund requests somewhere below the Howze Board recommendations and at a level they think will meet the approval of the secretary of defense, and beyond that, Congress.

For instance, the current, unresolved program calls for 4,587 aircraft in the Army by 1967. Howze recommended that this be increased by 6,034 for a total of 10,922. The actual level will be somewhere in between the current program and the recommendation. Defense Secretary Robert S. McNamara has approved the expansion of Army aviation to improve mobility, but the level is subject to practical considerations from year to year. Changes are made by what Defense Dept. officials call continuous programing.

In Fiscal 1963, the estimated obligations for aircraft will be $231.7 million. The Fiscal 1964 request is for $470.65 million. The figures for aircraft spare parts in the two categories are $17.9 million for Fiscal 1963 and $21.9 for Fiscal 1964.

The Fiscal 1965 budget request for aircraft procurement will be substantially higher than for Fiscal 1964. The exact size of the request has not yet been determined by the Beach group. After Gen. Beach makes his recommendation, there are three levels of review before the request is sent to Congress—the Army secretary, the defense secretary and the Budget Bureau.

From the standpoint of the entire force, which Beach must consider, the current cost is estimated at $1.662 billion. Howze recommended that this be increased to $3.784 billion of which almost $2 billion would come from reapportionments of procurement money for types of equipment considered inadequate for the new organization.

The new organization would eventually be 10 ROAD type divisions and six air assault divisions. The number of the two types of divisions could vary either way but the total would always be 16.

New procurement for the Army of Bell UH-1B and D Iroquois, Vertol CH-47B Chinook, Bell OH-13 Sioux and Hiller OH-23 Raven helicopters will be insufficient to meet the requirements of the reserve forces. It will take through Fiscal 1967 to phase from regular forces to reserve forces the Sikorsky UH-19 Chickasaw, until Fiscal 1968 for the Vertol CH-21 Shawnee, Fiscal 1968 the Sikorsky CH-34 Choctaw and Fiscal 1970 for the Sikorsky CH-37 Mojave. In the case of the CH-37, the schedule could be extended, depending on mobility tests.

Of the light fixed-wing aircraft some of the de Havilland U-6 Beaver aircraft will be phased to the reserves in Fiscal 1968 and the balance in Fiscal 1969. The Cessna O-1 Bird Dog will remain in the regular forces inventory for the foreseeable future. Phaseout schedules have been made only through Fiscal 1970.

A decision by the Army in the middle 1950s to concentrate on helicopters in place of light fixed-wing short-takeoff-and-landing aircraft is being reflected in current procurement. The above-mentioned helicopter buys will be augmented in the future by purchases of the light observation helicopter (LOH). The LOH competition is now in its final stages with Bell Helicopter Co., Hiller Aircraft Corp. and Hughes Tool Co. building and flying prototypes. The winning model will be put into production for runs lasting into the 1970s.

To fulfill the interim need for a heavy-lift helicopter, the special working group will budget for procurement of the Sikorsky CH-54A Skycrane. A contract for purchase of six from Fiscal 1964 funds was awarded last week (AW June 8, p. 27).

The Army also will evaluate three light helicopters as trainers beginning Sept. 20. Bell, Brantley and Enstrom will be in the competition (AW July 8, p. 27).

The Army is not abandoning light fixed-wing STOL aircraft altogether. The purchase of 20 Helio U-10 aircraft was disclosed last week (see box, p. 26).

In the larger, fixed-wing category, the Grumman OV-1 and AV-1 Mohawk STOL aircraft will be bought to fill reconnaissance and attack roles and the de Havilland CV-2A Caribou will perform the assault transport missions.

For the future, beyond the purview of the Beach group, Dr. Finn J. Larsen, assistant secretary of the Army for research and development, said: "If we are to deploy small units rapidly by air, the troops must be equipped with good lightweight, rugged weapons and equipment. In most cases the aircraft must be either helicopters or light fixed-wing aircraft since only small or unimproved fields are available."

A total of $82.1 million has been requested in Fiscal 1964 by the Army for research and development of new aircraft and related equipment. The heavy-lift helicopter capability will be pushed to a 12- to 20-ton payload, compared with the CH-54A's 8- to 10-ton capability.

Funds are now being put into tip turbine rotor development (AW July 8, p. 26). Hot cycle rotors and similar approaches are also being studied.

Helicopter armor is being developed that resembles honeycomb and weighs much less than conventional heavy armor plate. An integrated research program in aeronautics has been started and a helicopter is being designed as a complete weapon system. The Army is asking for $4 million in Fiscal 1964 to start the weapons helicopter project. The reason given for this project is that the new helicopter will push the limit of the rotary wing state-of-the-art adding 20 or 30 kt. to current top speeds.

Exploratory development will continue in the vertical takeoff-and-landing types of aircraft to see if any of them will be practical for Army use.

USAF Orders 44 U-10s

Helio Aircraft Corp. last week received a $2,391,911 Air Force order for 44 U-10 STOL aircraft the largest single order in the company's history. Twenty four of the aircraft will be assigned to the Air National Guard and 20 to Army representing first U-10 sales to both services.

The order preceded by two days the redesignation of four Air National Guard troop carrier groups as air commando groups. The units were redesignated to more closely identify them with their wartime unconventional warfare mission.

The four units, the 129th Air Commando Group, Hayward, Calif.; the 130th Air Commando Group, Charleston, W. Va.; the 135th Air Commando Group, Baltimore, Md.; and the 143rd Air Commando Group, Providence, R. I., currently are flying Grumman HU-16 Albatross aircraft.

The U-10, a military version of the Helio Courier, is a 5-7 passenger STOL utility aircraft capable of operating from small airstrips in mountains and jungles. A number of U-10s currently are in use by the military in Vietnam.

Training of the four reserve units, the first to be assigned an air commando mission, will be under the guidance and supervision of the Special Air Warfare Center at Eglin AFB, Fla. (AW June 3, p. 48).

All four units are scheduled to participate in the U. S. Strike Command maneuver, Swift Strike 3, commencing July 21.

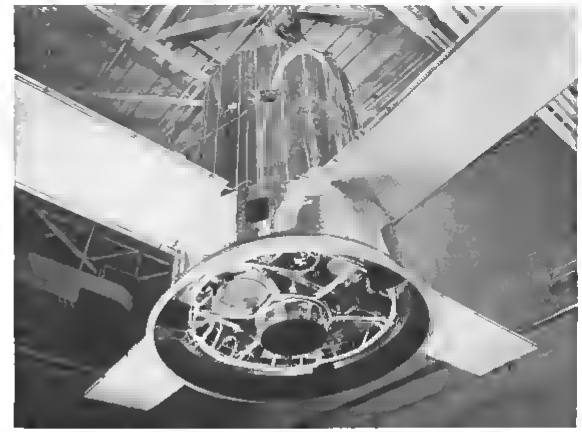
DOD Category Shifts

Washington—Defense Dept. research, development, test and evaluation categories used for programing and budgeting purposes have been changed.

Dr. Harold Brown, director of defense research and engineering, explained the changes in recent hearings before the House defense appropriations subcommittee. The new categories are research, exploratory development, advanced development, engineering development, operational systems development and management and support.

Research is the equivalent of basic research, the term used formerly. It is aimed at improving understanding of natural phenomena. Exploratory development is the equivalent of applied research the former term. This includes component development to prove feasibility as part of a study.

The former category of development has been divided into advanced development which leads to building test or experimental hardware, and engineering development, aimed at design of specific hardware for production. Management and support, a new category, covers repair, upkeep and overhead costs.



Advanced OSO Mockup Shown

Full-scale mockup of a proposed advanced Orbiting Solar Observatory (OSO) satellite is shown in a hangar at Republic Aviation Corp., Farmingdale, N. Y. Republic has received a $5.5-million contract from NASA's Goddard Space Flight Center to begin development of the satellite, with the first launch planned in 1967 (AW July 8, p. 27). The advanced satellite will have the same objective—measurement of solar radiation—as earlier solar observatory satellites. Large paddles contain solar cells to convert energy from the sun into power for internal instrumentation. Associate contractors are Honeywell for stabilization and control equipment, and Texas Instruments, which will provide communication and data processing systems.

P.1127 Crash Cause

London—Crash of a Hawker P.1127 VTOL strike fighter at the Paris Air Show (AW June 24, p. 26) was caused by failure of a valve component in the interconnecting control system between the cockpit engine nozzle position selector and the chain-driven nozzles.

When the plane crashed, the nozzles were locked at the 20 deg. back position after Pilot A. W. Bedford had selected the rearward position for his transition from hovering flight.

Comsat Corp. Seeks Study Contract Bids

Washington—Communications Satellite Corp. last week called for proposals for a study contract on a "multiple access" system of communication via satellite.

The corporation specifically solicited proposals from the four organizations that have already performed work on such a system, involving simultaneous access from a number of geographical points. These are: Bell Telephone Laboratories, Inc., General Telephone & Electronics Corp., International Telephone & Telegraph Corp., and Radio Corp. of America.

The firm noted that its proposal request (SCS-CD 1) "contains the criteria that the effort should extend previous work and studies completed with respect to the multiple access method ... and the results should permit design of a system embodying the particular multiple access system proposed."

The multiple access may be either by synchronous orbit or random orbit satellites. Awards of one or more study contracts are expected to be made by Aug. 1. They will be on a negotiated, fixed-price basis. Communications Satellite Corp. is aiming at a Nov. 1 deadline for completion of the studies.

New Firms Seek Astronaut Story Rights

By Alfred P. Ahlbrando

Washington—Withdrawal of Field Enterprises last week of its $3.2-million offer for the personal stories of the Gemini-Apollo astronaut team revived the controversy over commercialization of the nation's manned flight program.

Field's withdrawal did not diminish the exploitation value of space flight time, however. National Aeronautics and Space Administration officials said other interests, including Life magazine, which bought the rights to the personal stories of the original seven Mercury astronauts for $500,000, were ready to bid.

Field Enterprises Educational Corp., Chicago, announced on July 8 that it was withdrawing its offer after concluding that "further negotiations would be futile."

The announcement caught NASA Administrator James E. Webb by surprise. One of his aides said negotiations over language in the contract had been under way as late as the week prior to the announcement, and that "as far as NASA was concerned, we thought we had a contract."

Webb learned indirectly of the Field decision shortly before the firm announced it in Chicago. A telegram Field Enterprises sent to Webb, before the announcement, arrived at NASA headquarters on the afternoon of July 8 but did not come to the attention of Webb or his aides until the next morning. Immediately after the story of the withdrawal broke in Chicago, NASA said the agency could not comment because it had not received official notice from Field.

It was understood that the final breakdown after more than six months of negotiation resulted from a difference of opinion over review of material prepared by the 16 Gemini-Apollo astronauts or written for them. The Field clause provided for expeditious review by the astronauts or NASA. NASA, it is understood, changed this to require approval by NASA only, and eliminated references to timely review.

The Field contract would have covered book, magazine, newspaper, TV, radio and motion picture rights "for a period of 10 years or until [the] first landing on the moon."

In its withdrawal announcement, Field Enterprises said that Life magazine had "agreed to purchase domestic magazine rights in the projects Gemini and Apollo" from Field.

The Field contract proposal was far more comprehensive than the Life magazine contract with the Mercury astronauts, which provided exclusive rights to the personal stories of the original seven space pilots.

The controversial aspect of the sale of the astronauts' stories was conceded by Field Enterprises in its withdrawal announcement.

"... Reports of the negotiations were published in the nation's press," the announcement said, "and there was editorial as well as congressional criticism of the Administration's decision to allow the astronauts to sign a contract following Project Mercury. For the most part, this criticism took the line that it was inappropriate for America's astronauts to be placed on a private payroll. The critics insisted that the story of America's space program belonged in the public domain and that no matter how special are the attributes of the men who fly our spacecraft, they should not be privileged to share in financial rewards offered by an American communications company."

Rep. John W. Wydler (R.-N.Y.), a member of the House space committee and a critic of both the Life contract and the Field proposal, said he hoped there would be no new contract negotiations.

On July 1 he wrote to Webb urging him to disapprove the Field contract.

"... the basic problem," said Rep. Wydler, "is the effect the injection of commercialism has on the public's attitude toward the program.

"Astronauts ... must be above reproach and injecting a 'get rich' aspect into their motivation is damaging to the program's acceptance.

"It is doubtful that military regulations or presidential directives would allow such contracts in any other branch of federal service. The creation of a special category by NASA to allow acceptance of such compensation gives our space heroes the appearance of having feet of clay. These stories belong to NASA and the American people and should not be for sale."

Rep. Wydler suggested that NASA forbid such contracts and consider "raising substantially and equalizing the pay of all astronauts."

Rep. George Miller (D.-Calif.), chairman of the House space committee, said he did not believe it would be fair to forbid the contracts retroactively, but that it might have been in the best interests of the nation if the astronauts entered the program with the understanding they could not sell their stories.

The contract between Life magazine and the original seven astronauts was signed in 1959 with White House and NASA approval. From the outset to the end of the Mercury program, the contract and the investment of the money from it created a continuing controversy and provided the USSR with a convenient propaganda tool.

Editorials in U.S. newspapers attacked the contract on the grounds the "personal" stories of the astronauts were of interest only because of the great national program in which the seven were engaged, and therefore their stories should be public property that attaching a dollar sign to their adventures detracted from the seriousness and importance of the mission, and that other military pilots engaged in equally dangerous work were not permitted to enter into such contracts.

Russian broadcasts beamed outside the Soviet Union referred to the Mercury flight goal as the "golden idol."

Part of the money from the Life contract was invested by the seven in a Cape Canaveral motel, the Cape Colony. The astronauts were criticized for permitting their names and association with Project Mercury to be used in an obvious way—to attract guests to the motel. Agents for the seven are now attempting to sell this interest.

More TFX Subcontractors Named

Washington—General Dynamics/Ft. Worth has awarded additional subcontracts for the F-111 (TFX) variable sweep wing fighter-bomber being developed for the Air Force and Navy. Grumman Aircraft Engineering Corp. is the major airframe subcontractor and Pratt & Whitney will supply the TF30 turbofan engines. The subcontractor roster as of last week also includes:

AiResearch Manufacturing Co., division of the Garrett Corp., Los Angeles, Calif., refrigeration units; Avco Electronics Div., Cincinnati, Ohio, countermeasures receiving system; Dalmo Victor Co., division of Textron Inc., Belmont, Calif., radar homing and navigation system; Eclipse-Pioneer Div. of Bendix Corp., Teterboro, N.J., air data computer systems; General Electric Co., Johnson City, N.Y., flight control and armament control systems; GE, Utica, N.Y., tactical air command radar systems; Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn., air inlet controls; Litton Industries, Inc., Woodland Calif., navigation and attack system; McDonnell Aircraft Corp., St. Louis, Mo., escape pod; Minneapolis-Honeywell Aeronautical Div., Minneapolis-Minn., radio altimeter systems; Westinghouse Aerospace Electrical Div., Lima, Ohio, alternating current electrical power systems.

Still another storm gathered over the financial affairs of the seven in April, 1962 (AW Apr. 9, 1962, p. 28) when it was disclosed that Washington Attorney C. Leo DeOrsey, who negotiated the Life contract for them, had accepted new $24,000 houses for each in Houston, where the Manned Spacecraft Center is being built.

In a stormy press conference in Washington, DeOrsey said he advised the astronauts to turn down the home offers from the Houston Home Builders Assn. when he learned that NASA objected. He said the astronauts accepted his advice.

DeOrsey also said the astronauts turned down many requests to indorse products for fees, free life insurance and other gifts of value. He said that in signing a contract with Life, the seven were exercising the same right as generals, presidents and explorers who sold the stories of their adventures or experiences. DeOrsey also said he served as the astronauts' legal and business representative without pay or reimbursement for expenses.

Result of the NASA's difficulties and trouble over the Life contract during 1959 and 1960 prompted White House Press Secretary Pierre Salinger to say shortly after the Kennedy Administration came into office in 1961 that NASA astronauts would not be permitted to sell their stories after the Life contract ran out.

Change in the White House attitude is attributed to the personal persuasion of the original seven astronauts. It is understood that the astronauts—especially Lt. Col. Glenn—convinced President Kennedy there was nothing morally wrong with the Life contract.

The change of attitude in the White House prompted NASA to write a new policy concerning the literary, television and radio rights of the astronauts. The policy, made public in September, 1962, provided that accounts of the astronauts' experiences connected with their official duties were public property and could not be sold for exclusive use by one firm or company.

At the same time, NASA said that the astronauts had been advised that "no investment will be made which might create the impression that any participant in this program is placed in a position of benefiting from the activities or decisions of NASA."

The latter policy was aimed at the Cape Colony type of investment and in October, shortly after the policy was announced, DeOrsey disclosed that the astronauts' share was for sale.

Late last year, DeOrsey, representing the original seven, and Harry A. Batten, a Philadelphia advertising executive, representing the nine new pilots, accepted the Field Enterprises offer. In January, NASA and Bailey K. Howard, president of Field Enterprises Education Corp., began working with NASA lawyers and Webb on a contract which would be acceptable to the agency.

On June 5, NASA announced it would select 10 to 15 additional astronauts for training in connection with the Gemini and Apollo programs. This move was attributed as an effort to frustrate the Field Enterprises proposal (AW June 10, p. 25). But Field executives said it was the inability to negotiate a contract, not the problem of including additional astronauts that caused the withdrawal.

Howard said Field Enterprises still is interested in the book rights to the astronauts' stories, "if the price is right and somebody walks in here [Chicago] with a contract. We're not going to go to Washington or New York or Houston for any more negotiations."

Webb Protests House Unit's Cut Of $489 Million in NASA Budget

Washington—Reduction of the U.S. space agency's Fiscal 1964 budget by $489 million—to about $5.2 billion—would provide "an inadequate level of support for a program that is urgently needed," the agency's administrator, James E. Webb, said last week.

Webb made his statement July 10 after the House space committee completed its report on the National Aeronautics and Space Administration's authorization bill.

Webb said that at the $5.2 billion level NASA would "certainly have to slow up or postpone a number of programs and direct a reduction in the scheduled level of effort in the plants of our contractors where 90% of the work of the space program is done. Unless an adequate level of support is restored ... the stretch-out required will add to the final cost of the work required to carry out the program."

Prior to the July 4 recess, the committee cut $394 million from NASA's proposed budget for manned flight, space sciences and advanced research (AW July 1, p. 26).

Last week the committee voted to cut another $95 million from the $1,032,803,000 requested for application satellite programs and tracking and data acquisition.

The committee also recommended several amendments to the space act which would cut back NASA's authority to use money for purposes other than those for which it was appropriated. The reprograming of more than $200 million in funds during Fiscal 1963 irritated both the Senate and House space committee (AW Feb. 18, p. 38). Amendments provide for:

- **Approval of the House and Senate** space committees prior to the reprograming of funds for items or programs deleted or reduced by Congress or not requested of Congress.
- **Reduction from 3% to 2%** as the limit on funds that can be transferred from NASA's research and development funds to construction of facilities.
- **Separation of research and development** funds from operating and personnel costs in NASA's budget requests.
- **Elimination of authorization** to use money appropriated but not used in previous budget years "to improve NASA's bookkeeping processes."
- **Development of uniform design criteria** and construction standards and use of General Services Administration, Navy or Corps of Engineer standards until NASA develops its own.
- **Reduction from $250,000 to $100,000** as the maximum amount transferable from operating funds for a single minor construction project.
- **Broader authority for NASA** to use of funds for advance design work, which would permit better planning.

House space committee's report on the application satellites and tracking and data acquisition recommended:

- **Weather satellites**—Retention of the full $63.7 million requested.
- **Communication satellites**—Approval of $42.1 million of the $51 million requested. A reduction of $7 million was made in the $40 million asked for advanced synchronous satellite.
- **Tracking and data acquisition**—Reduced from $231.5 to $216 million.
- **Advanced application satellites**—All of the $1 million requested was disapproved.
- **Industrial applications from space technology**—The subcommittee voted a cut of $1 million of the $3.5 million requested, but the full committee restored the cut.
- **Construction**—Reduced from $121.7 million to $103 million. The largest reduction was a $10 million cut in the $90 million requested for modifying and equipping three ships as Apollo mission tracking stations.
- **Administrative operations**—Reduced from $560.3 million to $508 million.

NASA's Fiscal 1964 budget is still a long way from final approval in Congress. Hurdles on the House side include consideration by the appropriations committee and floor action on both the authorization and appropriations measures. The Senate space committee still has not made its report on the NASA authorization bill.

GE Lab Uses Rodent To Power Transmitter

General Electric's Space Sciences Laboratory recently operated a 500 ke. transmitter continuously for eight hours using electrical current generated in the body of a living rat as the sole source of power.

Power was developed across an electrode implanted under the rat's skin and a second one located in its peritoneal cavity. No biological functions were disturbed in the process, which resulted in a maximum power of 155 microwatts with a 500 ohm load at 0.23 v. Open circuit voltage was 0.68 v.

The experiment financed by a recently awarded $77,325 contract from National Aeronautics and Space Administration's Ames Research Center, is part of a two-year study of bioelectrogenesis which grew out of a biological fuel cell development program at GE. One biological fuel cell developed produces electric power from the interaction of yeast and glucose.

Under the NASA contract, GE will attempt to develop power sources for sensors and transmitters that could be used with experimental animals. GE will observe power production from rats and larger animals over test periods of at least six months, in an effort to determine if detrimental physiological effects will result and if electrical current being generated remains constant.

In one experiment under no load conditions, electrodes were left in a rat's body for six months—one-sixth the average lifetime of a healthy rat—with no harmful effects to the animal. Voltage across the electrodes remained the same as at the time the electrodes were implanted.

The generation of electricity in living organisms—called bioelectiogenesis—is of interest to medical and biological researchers, since recent advanced microelectronics devices, using a body's bioelectric potentials (AW Mar. 25, p. 69) allow electronic devices implanted in the body to regulate its functions or to monitor physiological reactions without using any externally connected wires.

V-107 Leasing

New York—Pan American World Airways has agreed to buy two Boeing Vertol 107 twin-turbine helicopters and lease them to New York Airways, the city's helicopter airline (AW May 13, p. 38).

Included in the agreement is a provision for helicopter service from the roof of the new Pan Am Building in midtown Manhattan to the Pan American terminal at Idlewild Airport. Approval for the rooftop service is still pending before the Federal Aviation Agency and city authorities (AW May 27, p. 36).

Draken Modified for Reconnaissance Mission

New photo reconnaissance version of Sweden's Saab J-35 Draken Mach 2 interceptor has a modified camera-carrying nose in place of the interceptor's radome. The modified aircraft, designated S-35E, shown on this and the opposite page, is scheduled to replace Saab S-29C reconnaissance aircraft presently in service with the Royal Swedish Air Force. The S-35E is equipped for both high and low level missions. Closeup photo of the nose section, opposite page, shows the location of various camera ports, all of which are fitted with defrosting devices. Note the apparently matched windows on the underside, probably used for stereoscopic or wide-angle photography. The camera nose slides forward to permit rapid access to the cameras and easy extraction of exposed film magazines after the mission. Nose separation is located at the seam just behind the side port, evident in the closeup photo. Saab says that a new Swedish camera sight and modernized navigational equipment have been incorporated into the S-35E. The new Draken version made its first flight last month. Saab Test Pilot Ceylon Utterborn was at the controls on the maiden flight.

Increasing Importance of Space Acknowledged in New DOD Post

Washington—Increasing importance of the role played by space in military missions was recognized last week by the creation of the post of deputy director of defense research and engineering for space technology. Dr. Albert C. Hall, 49, vice president and general manager of the Martin Co.'s Space Systems Div., was named to the post.

The post formerly was that of special assistant to the director, Dr. Harold Brown. The incumbent Dr. Lawrence L. Kavanau, will leave at the end of this month (AW Apr. 15, p. 25).

The Air Force, which is charged with responsibility for most of the principal military space missions long has complained that technical and operational control of space missions at the defense secretarial level was splintered and lacked the dignity of a title of sufficient stature.

Dr. Hall, as a deputy, will have policy and monitoring cognizance over space exploratory development, advanced development and engineering development along with responsibility for management and support of ranges and world-wide tracking networks.

Cognizance over major space operational systems however will rest with Dr. Brown and Dr. Eugene G. Fubini, who is in the No. 2 position as assistant secretary of defense—deputy director. He was formerly deputy director for research and information systems and in that position had similar space responsibilities.

Current realignments within Dr. Brown's organization, which are being made to match job descriptions with personal abilities and interests, will soon be completed. The turnover of scientific and engineering personnel, which peaks at two-year intervals, has now ceased.

The number of deputies will remain at six because the responsibilities of the deputy director for engineering and chemistry were redistributed after the departure of the current deputy, Dr. James H. Gardner.

Dr. Hall was graduated from Texas A&M in 1936 with a degree in electrical engineering and received his masters and doctor's degrees from the Massachusetts Institute of Technology in 1938 and 1943. He pioneered in radar and analog computers for missile guidance while at MIT from 1939 to 1950. He joined the Bendix Corp. as associate director of the Research Laboratories Div. in 1950, and became general manager and technical director of the division in 1954.

After joining Martin in 1958 as director of engineering at the Denver Div., he supervised the technical development of the Titan missiles. In 1960 he became Martin's vice president-engineering at Baltimore, and was named to his present position in January, 1962.

Dr. Hall will have two assistants. One is Brig. Gen. Paul T. Cooper, USAF, assistant director for ranges and space ground support. Title of the other assistant position has not been announced but the post—unfilled at present—will cover the technology and development aspects of space.

USAF Establishes Gemini Liaison Office

Washington—Air Force last week announced it is establishing a three-man Gemini liaison and support office at the U.S. space agency's Manned Spacecraft Center in Houston (AW Dec. 10, 1962, p. 10; Jan. 28, p. 26).

Air Force had hoped to have a 200-man Gemini group at the National Aeronautics and Space Administration's Houston facility by now and a participating role in the Gemini flight program.

So far, no agreement has been reached between the Air Force and NASA on Air Force participation in the program. Defense Dept. officials have indicated that Gemini development is now too far along for modifications necessary to experiment with manned satellite inspection, intercept and surveillance systems.

The USAF Gemini office, being established at Houston under Col. William A. Stellenwerf will concern itself primarily with the Titan 2 launch vehicle for Gemini and recovery requirements.

Vertol, Bölkow Agree to Exchange Data

Boeing's Vertol Div will gain access to two potential advances in the helicopter field under terms of a recently signed two-way technical assistance agreement with West Germany's Bölkow-Entwicklungen KG

The two projects, believed to be the major issues behind the agreement, are the Derschmidt high-speed lead-lag rotor system developed by Bolkow (AW Jan 28, p 29), and the company's cold jet rotor tip drive unit designed for use on large crane type helicopters

Bölkow in turn, can be expected to back the Boeing entry in a current West German government competition for a heavy turbine helicopter The competition reportedly has narrowed to the Vertol CH-47A Chinook and the Sikorsky S-61R (AW June 24, p 31)

Should the Chinook be selected, Bolkow also may be given license rights to build the helicopter in West Germany The present agreement, however, is non exclusive, and any production of the other's hardware by either firm would have to be covered by a subsequent contract It also leaves each company free to negotiate with other firms

The pact—one of the few postwar agreements under which a West German aerospace firm will be directly transmitting original design data to a U S counterpart as well as receiving it—provides primarily for "engineering and technical collaboration between the two companies in the field of advanced military wing development

Information exchange will be con ducted on a bilateral basis without charge to the recipient firm.

Bolkow also hopes to evaluate its flying test vehicle for the lead-lag rotor system (AW May 14, 1962, p 56) in the National Aeronautics and Space Administration s full scale wind tunnel at Ames Research Center, Moffet Field, Calif Similar facilities are unavailable in West Germany A formal application has been made for these tests to be conducted next spring and, if approved, Vertol will assist Bolkow in the evaluation

Further agreements between the two firms in areas extending beyond the helicopter field may be made at a later date Bölkow is a member of the West German consortium manufacturing the VJ 101 series of VTOL research aircraft (AW May 27, p 70) Boeing already has a technical assistance agreement in the VTOL field with France's Marcel Dassault and the French firm and Bölkow could be working together on a common project within the relatively near future (see box)

The present agreement was at least partially inspired by the West German government's decision to disallow a tentative Boeing proposal to purchase outright about a one-third interest in Bölkow

Talks between the two firms recently were halted while the defense ministry considered still uncompleted plans for merging the military research and development activities of several major aerospace firms located in southern Germany

The firms include Bolkow, Messerschmitt, Heinkel and Siebelwerke These activities, under current planning, would be centered around Bolkow's extensive research and development facilities near Munich

If taken, such a step is expected to be the forerunner to an overall move to consolidate the West German industry into one, or possibly two strong research and production consortiums (AW Feb 4, p 32) in an effort to prevent duplication of effort and the waste of defense funds

Should the push toward consolidation fail to win final government approval, stock purchase negotiations between Bolkow and Boeing, plus at least one other major U S firm, may be resumed

Franco-German Pact

Paris—West German and French governments have agreed to work together on the development and production of common military VTOL aircraft projects in what one official here last week termed as a "very general agreement"

West Germany may be willing however to join in the final development and production of a version of the Dassault Mirage 3V Mach 2 fighter particularly if data gained in the flight evaluations of the VJ 101 testbed aircraft could be incorporated into the final Mirage 3V design (AW Feb 4, p 32)

West Germany has no plans at this time to institute a production program for the VJ 101

In a related move, West Germany is expected to cooperate with Italy in the final development of a subsonic VTOL replacement for the current Fiat G 91 strike fighter series West German project in this area is the Focke-Wulf 1262, while Italy's Fiat is sponsoring the G 95/4 (AW June 24, p 67)

GAO Praises USAF for Savings

Washington — General Accounting Office, in a virtually unprecedented action last week complimented the Air Force in a report to Congress

GAO said that, after investigation, it estimated that USAF saved $41 8 million through competitive procurement of spare parts during Fiscal 1962

Sole source procurement of parts, generally from the aircraft manufacturer, has been a target of criticism by GAO over the past several years

GAO focused public attention on the tendency of the services to purchase aeronautical parts from the airframe manufacturer, without competition, in a report to Congress in May, 1961 (AW June 5, 1961, p 38) The report covered sole source procurement of 2,770 different types of parts costing the government $106 million The government could have saved "upwards of $30 million" had this $106 million procurement been made on a competitive basis, according to the report The report noted, for example, that nuts, procured by USAF for $1-83 each from the airframe producer, were subsequently obtained for 35 cents each under competitive procurement

Last week's GAO report commending Air Force for its increased effort in competitively procuring aeronautical parts also urged USAF to obtain more design information from its contractors This, GAO noted, would open the way for even more competitive procurement

GAO commented that it is "especially concerned with the type of restrictive legends contractors are permitted to place on data These limitations, which affect the government's ability to use the data for competitive procurement, stem from contractors' claims of proprietary interests in some elements of the information

We believe the Air Force has adopted an overly liberal interpretation of what constitutes satisfactory identification by contractors of information considered proprietary . . . "

USAF is developing this program to increase the quality of contractor-furnished information

- **Contractor participation** in determining whether an item is suitable for competitive procurement
- **Contractor recommendations** as to what data will be needed for competitive procurement
- **Contractor warranties** that the data furnished are the same as the contractor would use in competitive procurement of the parts
- **Contractor warranties** that the data are considered to be completely adequate for the expressed purpose of the government

DOD Claims Savings Of $1 Billion in Year

Washington—Savings of $1 billion were realized in defense spending in Fiscal 1963, yet military strength was increased as the result of a cost reduction program begun a year ago, Defense Secretary Robert S McNamara reported to President Kennedy

The original target had been $750 million Actions planned for the next two years, McNamara said, will result in savings of $4 billion annually by Fiscal 1967

During the same period he reported there has been a 100% increase in the number of nuclear warheads in the strategic alert forces, a 60% increase in the tactical nuclear forces deployed in Western Europe, a 45% increase in the number of combat ready Army divisions, a 30% increase in the number of tactical air squadrons, a 60% increase in the airlift capability, a 100% increase in ship construction and conversion and a 200% increase in special forces

Savings in buying were accomplished, he said, by reducing inventory requirements cutting spare parts stocks by tighter management and reducing the time cycle in overhaul of aircraft

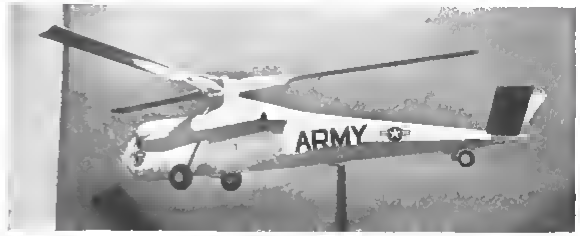
Excess inventories amounting to $1 2 billion were redistributed among the services and their contractors representing an increased rate of re utilization of one-sixth annually he said

For example, he said, 1 million excess Air Force 2 75 in rockets were transferred to the Army for use on helicopters 20 J 79 engines were transferred from the Navy to the Air Force for use in drone targets and 31 aircraft engines were shifted from Air Force to Army

In eliminating "goldplating" or building excess reliability in hardware McNamara mentioned as the most spectacular example the substitution of a $80,800 hydraulic device that opens and closes the doors of a Minuteman missile silo for a specially designed $555,000 electronic "mule "

Competitive buying, particularly on repeat procurement, has risen from 32 9% of the total in Fiscal 1961 to 37 6% after the first 10 months in Fiscal 1963, McNamara said He estimates that in Fiscal 1963, $800 million worth of business was shifted to competitive bidding, for a saving of $195 million The savings on aircraft components and parts was $40 million missile components and parts, $24 million and electronics equipment $40 million

The increase in cost plus-fixed-fee contracts has been stopped and a decrease has begun, McNamara said From 19 7% in Fiscal 1955, the percentage rose to 38% in Fiscal 1960 In the first 10 months of Fiscal 1963 it dropped to 19 1%, he said



MODEL OF HUGHES hot cycle research helicopter shows configuration as now developed Hot gases are ducted from the twin engines to cascade nozzles in the rotor tips Note directional control exhaust duets and V shaped control surfaces on the tail.

Hughes Develops Configuration For Hot Gas Cycle Helicopter

Hughes Tool Co 's Aircraft Div has developed a preliminary configuration for its research "hot cycle" helicopter, which it is developing for Army's Transportation Research Command under a $3 2 million contract Flight tests are scheduled for next year

Hot cycle system operates by taking exhaust gases from two turbojet engines and routing the hot high-pressure gases through duets to the tips of the rotor blades Cascade nozzles in the tips accelerate the gases and turn the blast 90 deg applying the force tangentially and turning the rotor blades

Designated Design Model 385 Hot Cycle Research Aircraft—it has no military designation—the helicopter will be powered with two modified General Electric T64 turboprop engines mounted on each side of the fuselage The engines, which were designed for turboprop operation will have the power turbine and drive shaft removed

The prototype will have an empty weight of 8,500 lb and a 55-ft-dia , three-bladed rotor A full scale rotor completed 60 hr of whirl testing early last year proving feasibility of the design according to a Hughes Tool official

The test rotor will be used on the first flight model

Primary advantage claimed for the hot cycle principle is its simplicity and weight saving compared with conventional shaft-driven helicopters Not needing a shaft the hot cycle copter is expected to avoid all but minimal torque reaction eliminating the need for a tail rotor Two small yaw jets also using exhaust gas, will be mounted near the fuselage tail, one on each side, for directional control during hover In forward flight conventional control surfaces on a "V"-shaped tail will provide directional control

Design studies project a rough two-to-one payload carrying advantage over conventional helicopters For distances up to 50 mi , according to Hughes, the Model 385 is expected to carry a payload of twice its empty weight The average payload for the latest types of shaft driven helicopters is slightly more than the aircraft's empty weight Hot cycle design is believed to be particularly applicable to large machines Hughes has been working on the concept under military contracts since the late 1950s, with support of all three services in the early stages

Saturn Launch Awards

Contracts totaling $43 million were awarded last week for construction work on Saturn 5 assembly and launch facilities at Merritt Island, just west of Cape Canaveral Fla

National Aeronautics and Space Administration's Launch Operations Center awarded a $23 5 million contract to the American Bridge Div of the United States Steel Co for construction on the 524 ft high vertical assembly building Blount Bros of Montgomery Ala , received an $8 million contract to prepare the site for the vertical assembly building

Ingalls Iron Works Birmingham, was awarded a $11 5 million contract for work on three umbilical towers at the Saturn launch site known as launch complex 39

Project Apollo manned lunar landing flights are to be launched from the 80 000 acre Merritt Island site in 1968, using the Saturn 5 booster and upper stages

Complex 39 will cost an estimated $440 million to complete The Merritt Island site is large enough to build six or more additional Saturn or Nova class launch complexes

Japan Begins Missile Development Tests

Tokyo—Japanese defense agency last week successfully launched two air-to-air missiles and one surface-to-air missile from Niijma Island into the Pacific The shots were part of an 11-launch test series scheduled to last until Aug 5

Five different types of missiles, all manufactured by Mitsubishi Heavy Industries, Reorganized, Ltd, are included in the series Test launches all will be from ground installations

The two air-to-air missiles launched were TAAM-2 Os (T prefix designates test status) The TAAM-2 O missile is about 9 1 ft long, 5 9 in in diameter and weighs about 141 5 lb It has four trapezoidal guidance fins mounted on the rear, forming an axially symmetrical cross

The solid fueled TAAM 2 Os, which developed 4,400 lb thrust for 1 sec, were launched on ballistic trajectories at 45 deg angles Maximum altitude attained by the missiles was 6,560 ft Downrange distance attained was slightly under 4 mi

The surface-to-air missile launched was a two stage TLRM 2D The TLRM-2D is 20 3 ft long, 16 5 in in diameter and weighs 1,067 lb Its booster stage has a double base solid fuel which produces 12,840 lb thrust for 3.5 sec Sustainer stage was a dummy for the test shot Both stages have control fins—trapezoidal on the booster and delta shaped on the sustainer—arranged in axially symmetrical crosses

The TLRM-2D (D designates dummy) was launched on a ballistic trajectory at a 60 deg angle to test launch and stage separation functions The booster stage reached an altitude of 6,560 ft and landed about 2 5 mi downrange. The sustainer stage landed about a mile and a half further

Four XAAM A 3 missiles, improved infrared homing versions of the TAAM 2-O missile, also will be launched The XAAM 3 A (X designates experimental) is described by the Japanese as a Sidewinder-type missile Length of the missile is about 8 5 ft, diameter is 5 9 in and weight is 154 lb

The XAAM-A-3 has four stationary trapezoidal stabilization fins set on the rear and four delta-shaped guidance fins on the front The infrared homing subsystem controls the front fins through a gas servo linkage Propellant is a solid double base fuel which produces 4,092 lb of thrust for 2 5 sec

The four test missiles will be launched at 15 deg on ballistic trajectories designed to carry them about 4 mi downrange

The remaining four launches will be with two TLRM-2, beam riding, surface-to-air missiles and two TSAM-1 surface-to-air missiles

The TLRM 2 beam rider is identical to the TLRM 2D, but the sustainer stage will be fueled with liquid nitric acid and kerosene Sustainer stage should develop 2,200 lb of thrust for 30 sec During flight the missile follows a radio beam, with hydraulic servos actuating the rear fins for directional control Planned launch angle for the shot, which will test all systems, is 60 to 70 deg

The TSAM 1 surface-to-air missile has preprogramed command guidance This also is a two stage missile and has the same dimensions as the TLRM 2D, but weighs slightly less The booster has trapezoidal stabilization fins and the sustainer has delta-shaped fins front and rear

Propellant in the booster stage is a double base solid fuel which develops 12,540 lb of thrust for about 3 5 sec The sustainer stage is powered with a liquid fuel engine burning liquid nitric acid and kerosene It will develop 2,200 lb of thrust for about 30 sec Guidance control on the sustainer is achieved with hydraulic servos which actuate the rear fins

Planned launch angle for the TSAM 1 shots is 60 to 70 deg and downrange flight is expected to be about 12.5 mi long Launches will include full systems checkouts

French Conduct Re-entry Tests

By Cecil Brownlow

Paris—Mach 12 re-entry tests to evaluate the proposed nose cone configuration for France's independent intermediate range ballistic missile (IRBM) weapon system have been started Launches mark the latest step in the nation's push to develop a nuclear tipped, submarine-launched IRBM by the late 1960s

France's Office National d'Etudes et de Recherches Aerospatiales (ONERA), which works directly under the Ministry of Defense, reported last week that two such firings have taken place thus far using the four stage Berenice research rocket as a booster Results from both were described as very satisfactory

Nose cone used in the firings from the navy's test launch facility on the Iles du Levant island chain near the Mediterranean port of Toulon was designed and built by Sud Aviation The solid-propellant Berenice was developed by ONERA in collaboration with the Societe d'Etude de la Propulsion par Reaction (SEPR)

First Mach 12 test was made on June 26 with a primary objective of measuring the heat flux along the nose cone during its re-entry into the atmosphere Second launching on July 3 was designed to evaluate the cone's protective covering under the same flux conditions as those measured during the initial firing

Total of eight Mach 8 tests of the nose cone had been conducted previously with the ONERA Antares, a smaller four stage predecessor of the Berenice

First two stages of Berenice fire the cone to an altitude of approximately 170 mi Last two stages plus the payload—in a maneuver resembling those performed by the Lockheed X-17 booster vehicle during the U S re-entry tests in the late 1950s—are then allowed to arc over and fall back to an altitude of about 34 mi before the last two stages fire downwards in rapid succession to propel the nose cone to a Mach 12 speed for the re entry simulation

Guidance, a must in view of the proximity of the mainland to the test area, is maintained during first-stage acceleration by means of a three-axis autopilot controlling four vernier rockets attached to the base of the unit Once the rocket is on course and after first-stage burnout, stabilization is maintained during the remainder of the upward trajectory by four stationary fins attached to the second stage Third and fourth stage stabilization is aided by the conical skirts housing the two separation points

Distance traveled during the 8 5 min of flight is approximately 70 mi An optical tracking system linked to an electronic destruct command unit monitors the flight during the initial 30 sec and can automatically order the rocket destroyed if it strays off course No attempts have been made to recover the two nose cones after their re-entry, but on-board equipment monitors the results and telemeters the data to an ONERA ground station

Berenice itself has a launch weight of 7,400 lb, substantially larger than its 3,900 lb Antares predecessor Overall length is 43 3 ft

With minor modifications, the Berenice also will be used as a sounding rocket in France's national space research program The rocket, with all four stages ignited during ascent could carry a 130-lb payload to an altitude of 620 mi

Atlas Fluorine-Oxygen Oxidizer Studied

National Aeronautics and Space Administration is considering a program to determine the feasibility of using a mixture of fluorine and oxygen (Flox) as an oxidizer in the USAF-General Dynamics/Astronautics Atlas space launch vehicle (SLV) to increase the booster's payload capability substantially. Possible benefits include:

- Meeting possible growths in satellites for which the Atlas has already been selected as the booster
- Use of the Atlas as a possible backup for the Martin Titan 2 booster in the Gemini program.

NASA was briefed June 20 by GD/A personnel on the Atlas' potential with use of the fluorine-oxygen combination as an oxidizer

Proportion of approximately 70% fluorine to 30% oxygen by weight is the optimum ratio for specific impulse gains with the JP 4 fuel used with the Atlas

Estimates are that an 18-20% increase in specific impulse might be realized with this proportion

However, use of 70% fluorine by weight probably would require such redesign in Atlas' Rocketdyne engine that the result might be considered in effect a new engine. Lesser percentages of fluorine, down to slightly more than 30% also might require extensive changes in the engine.

A concentration of 30% fluorine by weight probably would involve only minor modification to the Atlas boost vehicle This amount of fluorine in the oxidizer might result in a specific impulse increase of almost 10%, providing a booster capability for an additional 3,200-lb payload to a 100-naut mi orbit Estimate is that 35% fluorine in the oxidizer would be required to achieve an orbit with Gemini

If the Flox concept is implemented first launch in the feasibility program could be accomplished in a year and would involve considerable preliminary testing with the oxidizer combination Vandenberg AFB Calif, might be the launch site

News Digest

State Dept last week expressed hope that Britain, Spain, Canada and Mexico would further isolate Cuba by denying transit rights to transport aircraft operating to and from the Communist island Spain's Iberia Airlines is operating direct services to Havana Cuban and Czechoslovakian airlines are operating through Canada, Mexico and Britain's Grand Cayman Island on Cuban flights U S is concerned that Cuban Communists are entering South America via Grand Cayman

Douglas Aircraft Co and General Dynamics/Astronautics have been awarded contracts by the Marshall Space Flight Center for conceptual design studies on Nova class launch vehicles with chemical first stages and nuclear upper stages, capable of placing 1 million lb in earth orbit

General Dynamics Corp. will conduct a study of a nuclear pulse space vehicle under a $98,300 contract from Marshall Space Flight Center

Mason-Rust has been awarded a second one-year contract valued at $11,708,225 for support services at the Michoud Operations Plant in New Orleans

Air flow measurements with a traversing probe were conducted during a July 9 flight of the NASA-North American X-15 Joseph A Walker, chief NASA test pilot, took the No 1 aircraft to an altitude of 223,000 ft, reaching a maximum speed of 3,580 mph after an 84 sec engine burn time The retract able L shaped probe, mounted near the tail of the X-15, extends 3 in This was the third test flight with the instrument, which is being developed to gauge the flow of air at varying distances from the surface of the ship

First British Aircraft Corp. BAC 111 twin-jet transport starts engine runup tests this week at BAC's Hurn, England, production facility First flight will be made during the last week in July or the first week of August

Eleventh Minuteman ICBM was launched successfully recently from a silo at Vandenberg AFB Calif in a research and development firing executed jointly by Boeing and USAF's Ballistic Systems Div The firing was conducted to test over-all missile operation, provide subsystem data and validate improvements in various components

Douglas Missile & Space Systems Div will study requirements for a one to three-year manned Mars expedition during the 'unfavorable' 1975 1985 period under a $91,901 National Aeronautics and Space Administration contract (AW May 20, p 59) The study will consider needs of three to 10 astronauts during the mission, including a Mars stay of 10 to 50 days

Marshall Space Flight Center last week awarded a $249,103 contract to Space Technology Laboratories, Inc., for a comparative design study of modular stage concepts for lunar supply operations

Soviet Union has conducted tests of space launch vehicles in the Central Pacific, Tass said last week The second area in the Central Pacific restricted by the USSR for launch impact areas (AW May 20, p 30) has been reopened for ships and aircraft, Tass added

Andrew S Hazelton has been named corporate controller for Curtiss-Wright Corp He previously was the company's assistant controller

Brig Gen. Frank P Lahm, the second official Army aviator, died last week at the age of 85 Wilbur Wright taught Gen Lahm to fly in 1909 in an early Wright biplane, the first aircraft purchased by Army

Dr Nello Pace last week was appointed a consultant to National Aeronautics and Space Administration to study and coordinate its life science programs He will report directly to NASA Administrator James E Webb Dr Pace is professor of physiology at the University of California

United Aircraft Corp is offering subscription rights to common stockholders for $42,884,000 in convertible debentures Funds raised in the offering, underwritten by Harriman Ripley & Co, will be used to retire short-term bank loans United had forecast that its cash requirements this year would require additional short term borrowing, but the rise in its short term bank debt from $18 5 million at the beginning of 1962 to $44 million at the end of the year and then $55 million as of June 30, against a line of credit of $70 million, apparently caused the shift to long term financing

Gemini Suit Tests

B F Goodrich Co. will begin reliability tests next month on the Gemini space suit Four Gemini suits manufactured by the David Clark Co Inc will be used in the test program to determine how well moving parts, especially pressure sealing zippers, headpiece visor and glove connections perform in repeated usage simulating 10 missions of 14 days each

Technicians Score FAA on Traffic Control

RTCA report is highly critical of agency for failure to maintain pace with growth of air traffic volume.

Washington—Federal Aviation Agency's management of air traffic control was dealt another blow last week in a highly critical report issued by the Radio Technical Commission for Aeronautics (RTCA)

The RTCA report resulted from the third organized probe into this area in less than four months It followed a similar analysis made by the Air Traffic Controllers Assn., and a current survey of FAA's use of controller manpower being conducted by the General Accounting Office (AW Apr 8, p 49) FAA has not replied to either the ATCA or RTCA critiques, but has been conducting its own study of controller utilization for the past several months

General theme of the RTCA report, the second it has made on air traffic control since 1948, is that FAA's administration of the system has been inadequate to match the growth of traffic, despite the agency's ever-increasing budget for this purpose Rather than risk any further deterioration of the system while lengthy research projects are completed, FAA should take immediate steps to improve the system through a more efficient use of existing personnel and equipment, the organization said

Improved training programs and work standards for air traffic controllers, an increase in positive control airspace and improvement in existing radar equipment were the most significant among the more than 70 recommendations made by RTCA

Rapid rise in the cost of the air traffic control system over the past eight years and FAA's research and development program were particularly criticized by the committee, on grounds that the rate of increase is far out of proportion to the increased use of the system

RTCA noted that FAA's budget has "risen sharply" from the $108.2-million level of 1955 to $722 million for Fiscal 1964 While it recognized much of the increase was caused by the addition of higher-priced equipment, RTCA said "It is a matter of serious concern, however, that these capital investments show no tendency to produce dividends in the form of reduced units" such as per aircraft or aircraft mile

Between 1955 and 1960 FAA costs per aircraft increased 244.5%, while civil aircraft registrations increased only 30.8% Actual aircraft miles during this period increased 29.3% but FAA costs per aircraft mile increased 223.8%. In a further comparison of air traffic activity with FAA costs the report found that from 1957 to 1962, when total IFR operations increased only 25.3%, FAA costs rose 188.5% Total airport operations increased 44.8% from 1955 to 1962, whereas FAA costs rose 470%, RTCA stated

In a breakdown of costs of typical equipment needed for air traffic control, the organization noted that the expense for such items as a terminal VOR at $120,000 has a direct effect on just how many essential aids can be acquired within FAA's budget

"There is some question that excessive specifications have at times been used," the report said

While RTCA did not elaborate on this subject, a similar question was raised recently by S. B Pontsky, navigation manager of the Air Transport Assn (AW June 24, p 50)

Pontsky advocated the use of more "off-the-shelf" commercial equipment, as opposed to FAA's current practice of having equipment built to rigid specifications He pointed out that several states that purchase and install their own navigational aids pay only a fraction for the almost identical type of equipment As an example, he noted that FAA customarily budgets $25,800 for a 75-mc fan marker, whereas the State of Nebraska buys and installs a dual installation for only $3,250

Part of the difference in cost arises from the fact that FAA often provides unnecessarily large and costly buildings for the installations under separate contracts Pontsky said He contended that FAA could stretch its dollars further by first making certain that such an elaborate installation is justified in relation to its expected use, and then contracting the entire effort as a single project In this manner he said, Minnesota has been able to purchase buildings for dual VOR equipment at a cost of only $10,000 compared with FAA estimates of $55,000

Research and development on which FAA and its predecessor the CAA will have spent an estimated $300 million by the end of Fiscal 1964 came under strong criticism from RTCA

FAA has failed to provide any method of keeping the aviation industry adequately informed on its specific research and development projects the organization charged Release of reports to the public has often been delayed months, and many of the statements finally released are not adequately supported or justified Except to a limited degree the industry has not been afforded the time needed to conduct a detailed discussion of individual projects, according to the report

The lack of sufficient and timely reports has made it difficult "if not impossible" for the industry to determine exactly what recommendations to offer or to judge the value of the various projects, RTCA said

Reviewing the present air traffic control system, RTCA found it has become so complex that it constitutes a hazard for the user, who is faced with a wide variety of rules, procedures and regulations An effort to simplify the system should be undertaken the group said

As a result, the workload has been increased for the pilot to a point where it is now a "critical problem" to force him to comply with a variety of extra navigation and communication tasks in addition to flying the aircraft, RTCA said The air traffic control system should have as one goal a reduction of this cockpit workload it added

As the rate of air traffic increases so too does the workload of the air traffic controller, who must handle added procedures that complicate his task, the group said To keep the workload in bounds RTCA said he is forced to reduce his area of control as the number of aircraft per square mile is increased

Result of this process, which has been intensified by the speed of turbojets is that the controller has very little time to analyze the traffic make a decision and act on it the report said In addition his task is complicated further by the necessity to operate intricate switches and controls that divert attention from the controller's primary function

Scope of the controller's job also has been expanded to include extra duties many of which are not directly related to traffic control, the report said RTCA cited weather reports to pilots as one example and urged that FAA examine the controller workload to assure that all tasks are for the primary purpose of air traffic control

Prior to World War 2 controller applicants were thoroughly screened for high qualifications and trained to handle several related positions Since then thousands of new controllers have been added and the job requires more specialized training RTCA said noting that a "resultant deterioration in the proficiency of the finished product is easily discerned"

With the broad expansion of duties required of today's controller more care should be given to the selection and particularly the training of the individual applicant" the report stated RTCA suggested that FAA develop a special aptitude test for controllers give them an intensive indoctrination course at the agency's academy in Oklahoma City, plus continuous upgrading, refresher and competence courses

FAA has recently reduced a great deal of its traffic control course at Oklahoma City in favor of more active "on the job training" at towers and control centers throughout the agency's seven regions

There has also been some dissatisfaction among controllers over a planned job classification change now being prepared by FAA under a former agreement with the Civil Service Commission Grade classification pay scales which are presently set under a traffic formula for tower controllers, will be changed to combine the present four levels of traffic volume into only three FAA contends the change will have virtually no effect on controller pay, but the Commission concedes that a 'few may lose"

RTCA urged that FAA extend its program of positive control of airspace in the higher density terminal areas such as New York Los Angeles Chicagn and Washington D C The organization did not define any dimensions for the controlled area, but said that the control should be established even at terminal areas that lack en route control segments below 18,000 ft A variation of this idea has been used by FAA at Atlanta Ga for some time and should be continued RTCA said The organization also recommended that FAA continue expanding its area positive control over aircraft flying at and above 18,000 ft

One of the controller's largest problems is the original and continuous identity of aircraft on radar scopes the report noted Top priority should be given to equipping these radars with air traffic control radar beacon system decoders capable of identifying several different aircraft from airborne signals simultaneously RTCA said Each radar position should be provided with independent controls for this purpose so that identity and altitude information would be displayed adjacent to the radar target

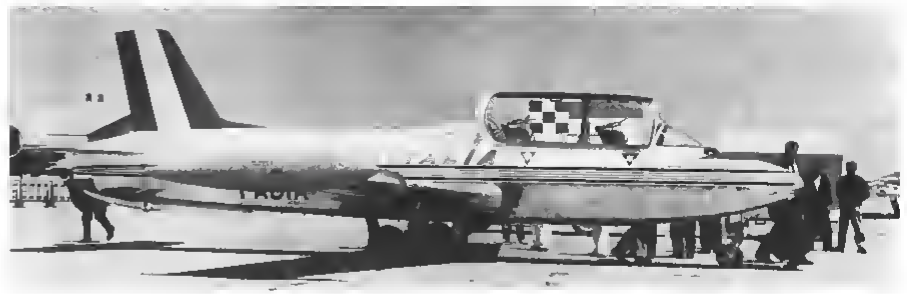
Western Seeks Fare Reduction

Los Angeles—Western Air Lines has filed intention of reducing its fare between Los Angeles and San Francisco, a move which probably will intensify its competition with Pacific Southwest Airlines over that important intrastate route (AW July 1, p 48)

Western wants to reduce the fare on its Los Angeles-San Francisco all-coach Lockheed Electras to meet the $13.50 (plus tax) one-way fare charged by PSA a California intrastate airline, which operates six turboprop Electras on a San Francisco-Los Angeles-San Diego route. Western's fare change will go into effect Aug 1 unless suspended by the State Public Utilities Commission which is unlikely

Western's new low fare will apply only to intrastate passengers Those connecting from out-of-state to the carrier's three daily Electra flights each way between the two cities will have to pay the present $16.95 fare. "We're lowering the fares to meet the PSA competition," a Western official conceded Western also has 11 Thriftair Douglas DC-6B flights each way daily between San Francisco and Los Angeles charging $11.43 one-way in addition to six Boeing 720B turbojet flights daily each way at higher prices

PSA is the No 1 carrier between the two cities with Western now a close second PSA added a sixth Electra to its schedule in late June and now operates approximately 290 flights weekly, one-way north or south



Alitalia to Use MB.326 in Pilot Training

Alitalia, Italy's national airline has purchased several Macchi MB 326 jet trainers for use at the carrier's flight training base at Brindisi in Southern Italy Alitalia has been forced to supplement its pilot roster since the usual source of recruits the Italian armed services has not been furnishing enough pilots One hundred student pilots are in training at the Alitalia Engineering Center at Fiumicino.

Il-62 Progress

Moscow—Soviets are now test-flying three prototypes of the Ilyushin Il-62 jet transport in the certification program for Aeroflot but they are not using the engines planned for production models of this aircraft.

The Il-62 (NATO code Classic), which made its initial flight in January, 1963, is now using four conventional military turbojets of 18,000 lb. thrust each housed in two aft-mounted nacelles on either side of the fuselage

Production versions which Aeroflot is anticipating for airline use will be powered by four Kuznetzov turbofan engines to be rated at 23,000 lb thrust each. The Kuznetzov turbofan engines are still under development. They are running in ground test rigs but have not yet begun flight testing.

The two aft-mounted nacelles will be modified from the present configuration to house the turbofan engines but there will be few external modifications.

Concorde Tests at U.S. Facility Approved

By L. L. Doty

Washington—U S Air Force and Federal Aviation Agency plan this week to announce approval of Bristol Siddeley's request to use the Arnold Test Center to test the Olympus Mark 593 engines that will power the Concorde supersonic transport (AW July 8, p 28)

The decision was made to permit closer collaboration between the Anglo-French Concorde project team and the U S in the development of a supersonic transport and, according to one top government official, a better opportunity to observe the progress toward supersonic application of the proposed Concorde powerplants. He added that the USAF test center at Tullahoma, Tenn., is the "only place in the world" where Bristol Siddeley can test the Olympus engine

Meanwhile, the U S position in the supersonic transport race remained clouded last week with no tangible signs that a U S project would be launched in the near future Thus far, only Pan American World Airways has placed an order for the Concorde Neither Air France nor British Overseas Airways Corp had made an official announcement of any order by late last week, although both carriers reportedly are assured of joint positions on the production line with Pan American

Continentol's Interest

Continental Air Lines is interested in the Concorde but has not yet placed an order for the aircraft The airline's president, Robert Six did discuss the probability of buying three Concordes with a member of Vice President Lyndon B Johnson's supersonic transport advisory group several weeks ago

Government officials here state how ever, that Six did not discuss the prospect directly with Johnson nor did he make a formal assertion, either orally or through correspondence, of an intention to purchase the Concorde Six is known to be a staunch supporter of the supersonic transport In the airline's bid for a West Coast-Hawaii route in the Transpacific Route Case Continental's plans to buy the first available supersonic transport for use on the route were used to support the carrier's case The CAB dismissed this issue as irrelevant to the proceedings

Indications are strong that Continental eventually will place an order for the Concorde if the U S project is delayed much longer, or if the U S design is not suitable to the carrier's prime route between Chicago and Los Angeles

Other U S carriers last week were watching developments cautiously but there were no immediate signs they would rush to order Concordes Pan American's principal competitor on the North Atlantic, Trans World Airlines, stated only that it was keeping a close eye on the Concorde program

A number of airline officers and government officials were privately dismissing the Pan American order and the report of the Continental interest in the Concorde as "publicity" gestures Others, feeling that the introduction of the supersonic transport is the next inevitable step in air transportation, viewed the purchase of a place on the production line as "good business at little cost"

At least one major European carrier indicated last week that it would soon order a fleet of Concordes and chances are strong that others will soon do the same

The U S continues to shun a bid to enter the Concorde project (AW July 8 p 28), but the possibility of a tripartite consortium (AW June 17, p 40) has not been ruled out entirely in Administration circles However, Federal Aviation Administrator N E Halaby has rejected the proposal flatly and questions whether the French and British have an "18 month lead over the U S" in the Concorde project primarily because the group has "no test facilities no fabrication no temperature limits"

On the other hand the decision to grant use of the Arnold Test Center to Bristol Siddeley was based, in part, on the opportunities such testing will give U S engineers to observe what the Olympus engine "can or cannot do" Technical information on the development of a U S supersonic transport would be available to Snd Aviation and British Aircraft Corp, joint manufacturers of the Concorde, through the exchange of data within NATO

U. S. Development

U S government officials feel the U S project, once it is started, will move faster than the Anglo-French project One official claimed that, while the European consortium is "getting good publicity" the combination is "cumbersome" and is likely to get bogged down under the joint arrangement

He added that determination of whether the U S proposed project or the Concorde is superior is still a "guessing game" A representative of the French-British team last week admitted that basic minimum requirements of the Concorde—range, speed and payload—are still vague, which could be a prime reason that a rush of orders has not developed BOAC officials have admitted they have postponed placing an order until more is known about operating performance and characteristics of the airplane

The U S project of course is not as advanced as the Concorde program and basic design work remains yet to be done

Seaboard-BOAC Cargo Pact Set

Washington—Seaboard World Airlines and British Overseas Airways Corp last week signed an agreement for operation of Seaboard's Canadair CL-44 turboprop all-cargo transports on the British carrier's transatlantic routes

The agreement differs from a pact signed with Lufthansa German Airlines two years ago in that BOAC will lease a plane from Seaboard as well as purchase "blocked space" on a plane operated over the route by Seaboard Under the Lufthansa agreement, the German carrier merely leases a pre-determined volume of blocked space on a daily all-cargo CL-44 flight operated by Seaboard between Frankfurt and New York

The U S all-cargo airline has a similar agreement with Swissair on a much smaller scale, with the European carrier purchasing only 2,000 lb of space on a once-a-week flight

Seaboard created the "blocked space" plan several years ago as a means of correcting an imbalance of traffic on westbound and eastbound flights While traffic moving westward was heavy, the airline flew to its home base with low payloads because most European cargo destined for the U S normally was carried by the national airlines of the shipper's country

Under the blocked-space plan, Lufthansa, for example conducts cargo sales under its own name to German shippers and then transports the freight across the Atlantic in cargo space it has leased from Seaboard on the latter's plane Seaboard fills the space unused by Lufthansa with its own cargo

Under the agreement with BOAC, the British airline will lease one CL 44 plane from Seaboard, which will permit it to operate three round-trip transatlantic all-cargo flights per week On alternate days, BOAC will lease blocked space on CL 44 flights operated by Seaboard Contract is subject to approval by government aviation authorities of both nations

Lone DC-4 Plays Short-Haul Role In Island Airlines-FAA Struggle

Honolulu—Island Airlines, a cut-rate Hawaiian air carrier, last week appeared to have ended its struggle with the Federal Aviation Agency after the two engaged in a tug-of war with the airline's single Douglas DC-4 aircraft

Late last week the airline, which has been operating inter-island skybus flights in the face of FAA orders to suspend service until receiving an airworthiness certificate (AW June 10, p 43), agreed to pay the agency $12,000—$1,000 monthly—as a compromise settlement of civil penalties allegedly incurred by the company for infraction of regulations In addition, it agreed to discontinue service until the certificate was granted

Late last month, FAA assessed the carrier $90,000 in fines and ordered seizure of the 79 passenger aircraft The plane was towed to a storage area on orders of the U S marshal's office, but the following day, a state circuit judge issued a temporary restraining order on grounds that the seizure would cause "irreparable damage" to the airline

A local sheriff liberated the plane and it was released to the airline The U S marshal later confiscated the plane again and had it towed to an FAA hangar, but later the same day, an unknown party returned with the original restraining order, presented it and returned the airplane once again to Island

The airline promptly resumed services with the recaptured plane, and Island President Walton E Wood slept in the plane that night presumably to make certain that the company property remained available for subsequent service Here is a chronology of events before the settlement with the FAA

• **On June 24,** Federal Judge Martin Pence postponed until July 15 his scheduled hearings on a Civil Aeronautics Board petition for a restraining order and temporary injunction grounding Island Airlines CAB holds that it has jurisdiction over Island since the carrier operates over international waters on its inter-island service and is thus not an intrastate airline Pence also scheduled hearings for the following day on whether he should dissolve the state court's seizure order

• **Federal Judge** Harry C Westover, sitting for Judge Pence, postponed hearings on the seizure issue until he could familiarize himself with the case U S attorneys delayed further seizure pending Westover's decision

• **Island continued** to fly sporadic schedules, but announced on July 2 it would discontinue operations "indefinitely" rather than risk FAA discipline against flight crews of the airline

• **On July 3,** Westover denied the government's request for a temporary restraining order and injunction to ground the airline and set Aug 5 for hearings on a permanent injunction motion based on FAA complaints The airline resumed operations

• **Wood** and his attorney, Frank D Padgett flew to Washington on the invitation of the Justice Dept Following discussions in Washington, the airline and the U S attorney's office in Hawaii signed an agreement that, as of late last week had brought the FAA Island feud to an end

FAA agreed to dismiss without prejudice its civil penalty proceedings against Island upon payment of the first installment of the $12,000 fine This was done and the FAA agreed "to promptly process" Island's application for contract and common carrier certificates

If the federal circuit court should conclude hearings, which were to begin July 15, by denying a CAB petition for preliminary injunction against Island on the "ground that Island is not subject to the jurisdiction of the CAB" then FAA will promptly issue a certificate entitling the airline to carry on scheduled operations under Part 45 of FAA regulations Island has discontinued service pending such issuance

When the certificate is granted, Island will launch full time scheduled operations in direct competition with two scheduled carriers, Aloha Airlines and Hawaiian Airlines Aloha, meantime, has announced that the on and-off service conducted by Island during the past two months has caused a 6% drop in its traffic and says it will be required to appeal for additional federal subsidy

VC.10 to New Zealand

London—Vickers Armstrongs last week was making final arrangements to fly its four-jet VC 10 transport to New Zealand next month for a series of demonstrations to Teal, the New Zealand airline, at Harewood and Ohakea

According to present plans, the VC 10 also will be demonstrated in Cairo and in Australia, although the Teal re-equipment order is prime target of the trip

To date, the VC 10 has been demonstrated only in Great Britain and at the Paris Air Show.

American Pact With New Union Reduces Flying Time Requirement

New York—Allied Pilots Assn has successfully negotiated a two year contract with American Airlines, granting pilots and copilots reductions in monthly flying times increases in retirement benefits and work rule changes

The contract, effective until July 9, 1965, was termed "a complete nullity" by an Air Line Pilots Assn spokesman, whose union is fighting the recognition of Allied as the legal bargaining agent for American Airlines pilots (AW July 8, p 28) ALPA has two court actions pending which could nullify the new contract

A spokesman for Allied Pilots termed the contract, "the best in the industry it will take the rest of the industry four to five years to catch up" An American Airlines spokesman said the company was satisfied with the contract Total cost to the carrier under the new pact is approximately $7 million annually

The contract included these major provisions

• **Retirement and disability** The carrier will pay a minimum of $600 per month after retirement at age 60 and a minimum of $600 monthly for any disability received after 15 years service Former retirement benefit was $400 per month

• **Reduction in monthly flying time** Monthly jet flight time was reduced from 85 hr to 75 hr Piston flying time, including turboprops, was cut from 85 hr to 80 hr

• **Promotions** Under the new contract, there will be provision for 53 to 60 new Boeing 707 and 720 captains, 25 new Convair 990 captains and about 100 new propeller aircraft captains with corresponding promotions among copilots The pilot group will benefit by an additional $4 000 to $6 000 per year in salary, although no actual pay increases are contained in the contract

• **Time off** Vacations will be increased by about 6 days per year on a system-wide average Guaranteed additional days off will be increased from four 48-hr periods per month to five 48 hr periods monthly

• **Sick leave** will be charged only against those days that a pilot would have flown That is, a pilot sick for a month in which he was scheduled to fly 16 days would lose only 16 days sick leave Annual sick leave is increased from 14 to 16 days, with a total accumulation of days increased from 84 to 126

Maytag Urges Mach 2 SST Development

Miami Beach—Building a Mach 3 transport would be a "mistake and seriously detrimental" to the U S economy, L B Maytag, Jr, National Airlines president, told the National Aerospace Education Council here last week

Maytag urged that the U S push ahead with development of a utilitarian Mach 2 transport and abandon the attitude that greater speed, capacity and longer range make for a better aircraft

This philosophy is only good to a point, Maytag said and "may cost us the supremacy in world airframe manufacture which we are striving so hard to maintain Now that we are on the threshold of supersonic commercial transports, where speed is measured in Mach, we are discovering that devotion to size, range and speed is archaic thinking"

By committing itself to a Mach 3 transport, the U S will have an aircraft suitable only for long nonstop operations such as transatlantic and transpacific service, Maytag said Of 11 U S trunklines, only three—Pan American, Trans World, and Northwest—could probably use a Mach 3 transport advantageously, he noted United Air Lines might possibly use a Mach 3 aircraft on its West Coast-Hawaii routes Maytag added, but it is "unlikely that United would buy such an expensive aircraft for use on only one segment of its vast system"

Mach 2 Market

"If the United States does not develop a Mach 2 aircraft American trunk carriers will be forced to turn to foreign manufacturers," Maytag warned

U S government and industry support of a Mach 3 transport on the grounds that its speed, range and capacity will render a Mach 2 aircraft obsolete before the latter is built is invalid, Maytag said "The identical comments were made about the Lockheed Electra when it found itself in competition with pure jets the Electra did not become obsolete nor will a Mach 2 aircraft ," he said

Electra experience on such routes as Washington-Miami and Los Angeles San Francisco has shown that the passenger can arrive sooner by using the slower turboprop aircraft in preference to the pure jets, Maytag said

The same paradox would exist on domestic routes if a Mach 3 transport were used rather than a Mach 2 aircraft, he added, largely because of the takeoff and approach measures needed to minimize damage from sonic boom

Maytag said that under the present engineering concept, "the Mach 3 has to climb 12 mi before it can go into supersonic regime to achieve 2,000 mph speed, the plane will still have to climb gradually in order to spin the sonic boom--or the overpressures—out into space

"By the time the aircraft has leveled off and is flying at cruising range, the work will begin on a much more complicated descent The plane cannot tip toward the ground at even the most shallow of angles without the overpressures creating a sonic boom

"At a 12-mi altitude the plane once again will begin a climb as it throttles back By the time it has reached a subsonic speed of about 600 mph, it will then make a gradual descent to its destination airport," Maytag said

"The Mach 2 airplane is comparatively safe from overpressure ground effects above 50,000 ft Thus, while the Mach 3 airplane is still climbing at a subsonic speed the Mach 2 is streaking along about 1,500 mph."

Transcontinental Flight

On a 2,345-mi Miami-Los Angeles nonstop flight, the Mach 2 aircraft would arrive first, Maytag said If both aircraft could take off simultaneously and instantly reach cruising speed, and both stop instantly from cruising speed, the Mach 3 aircraft would arrive in Los Angeles 23 min ahead of the other, he said

In reality, the Mach 3 aircraft would catch the Mach 2 transport "somewhere over Texas," Maytag said In the vicinity of Albuquerque, however, the Mach 3 aircraft would have to begin complicated descent procedures, and the Mach 2 would again push ahead Maytag added

"By the time the Mach 3 aircraft lands at Los Angeles International, the passengers aboard the relatively slower Mach 2 will have had time to pick up their baggage and be gone," Maytag said

Maytag also questioned the cost of developing a Mach 3 aircraft, which he said is estimated at $1-$2 billion

"If the development costs of a Mach 3 aircraft are to be picked up by the carriers who purchase the aircraft," Maytag said, "the sale price of each aircraft will approximate $30 million Its potential sales are so limited that a per unit cost could indeed far exceed the $30 million by as much as half again"

By comparison, Maytag pointed out that the selling price of the Anglo French Mach 2 transport, the Concorde, currently is estimated at about $8 million—little more than the $6 2 million price of a Douglas DC-8F jet transport

The government's attitude that it must underwrite development costs of a Mach 3 transport leads to "another more alarming possibility The history of free enterprise has proved time and again that the product of any manufacturer is inestimably better when it competes with a similar product from a rival manufacturer the history of aviation under complete government subsidy is fraught with uncompetitive failures," Maytag said

It would be better Maytag said, with either a Mach 2 or Mach 3 aircraft to have more than one manufacturer's proposal carried "at least through the prototype evaluation [rather] than to save money with a chance of failure"

Program Cost

The problem, Maytag pointed out, is that no single manufacturer in the U S has sufficient capital to underwrite the cost of a supersonic transport program, yet under the free enterprise system, these development costs should be included in the price of the aircraft

"Such costs are prohibitive and the only possible answer would be continuing mergers of our carriers until we reach a gigantic amalgamated airline operating on a monopolistic non-competitive basis," he said

The logical answer is for the U S to concentrate on developing an economical, efficient Mach 2 transport if it is to lead the world in manufacture of commercial aircraft, Maytag said

"On a Mach 2 aircraft of American manufacture, the development costs are not so great but that they can be absorbed by private industry," he noted "We will be competing on an even basis with the British and the French consortium, but we will have a tremendous advantage because—under the free enterprise system—there will be rival ventures within the United States"

Bonanza DC-9 Order

Las Vegas—Bonanza Air Lines has ordered three Douglas DC-9 turbojets for delivery in early 1966 Initial down payment on the estimated $9 million price has been made under a purchase agreement giving Bonanza an option on three additional DC-9s in the future Financing will be arranged under the Guaranteed Loan Act subject to approval by the Civil Aeronautics Board and the Commerce Dept. Delta Air Lines has also ordered 15 DC-9s, with an option for an additional 15.

First World Airways Boeing C-Jet Flies

World Airways Boeing 707-320C long-range, convertible cargo/passenger transport takes off from Renton, Wash., Municipal Airport on its initial flight The new "C-Jet" is first of three the airline will use in transpacific non-stop passenger operations and transpacific cargo service via Anchorage, Alaska Planes carry 188 economy-class passengers or 90,000 lb of cargo

Program to Soundproof Houses Near London-Heathrow Rejected

London—British government has rejected a proposal to provide grants for soundproofing houses in the vicinity of London-Heathrow airport This was one of several recommendations on noise control made by the Wilson committee on the problem of noise, set up in 1960

The committee, headed by Sir Alan Wilson, in a report to Parliament, stressed that noise to which people near London Airport are subjected is more than they can be reasonably expected to tolerate, and added

We are convinced that the degree of exposure to noise in areas close to the airport will not be materially reduced and, indeed, will get a good deal worse unless appropriate measures are taken now" These recommended measures included

- **Reduction of noise** of individual aircraft as new types come into service
- **Provide houses** near the boundary of the airport with better insulation against noise

The committee said that a reduction of 7 pndb (perceived noise decibels) in the average peak noise level of aircraft is required to offset the increased number of jet movements expected at the airport between 1961 and 1970 The only possible way in which this could be achieved is by exploiting improvements in engines and aircraft, the committee added

Ministry of Aviation presently is spending about $1 2 million a year on research and development in the causes of noise Much of the work centers on engine noise suppression at the National Gas Turbine Establishment

At London Airport, operators are limited to a noise factor of 110 pndb and are not allowed to take off after midnight unless they have proven a high degree of compliance with this noise limit A number of services have been approved at night for airlines which have demonstrated that they can operate at noise levels not exceeding 102 pndb

Ministry of Aviation has allowed operators freedom to achieve the noise limit in any way they can, subject to the main consideration of safety Two techniques in general use are

- **Full power used** on takeoff to gain a steep rate of climb until the aircraft approaches the first buildup area Just before this point power is reduced to the minimum thrust needed to maintain a gentle climb with safety, full power is added after passing the area
- **Reducing total fuel** to enable the airplane to climb to a height where the noise level will be within the limit following the power cutback This usually causes a later stop for refueling at considerable cost

Currently, Ministry of Aviation is monitoring about 90% of all takeoffs from London-Heathrow, but the Ministry soon will introduce new equipment which will automatically measure the noise level of all takeoffs

The committee has rejected a suggestion that all aircraft be towed during ground operations The group noted that this contribution to noise suppression would not counterbalance the difficulties created for the airport authorities and the airline operators

In reporting to Parliament the committee emphasized the commercial aspects of noise suppression at London, noting

"If, in the interests of noise reduction, restrictions are placed upon airline operators at Heathrow which have such serious economic penalties that the use of the airport becomes unprofitable for them, they may transfer their operations to other airports abroad A substantial reduction in the air services to Heathrow, which serves London and the whole country, would have grave deleterious effects on the country's economy"

In reference to soundproofing houses bordering Heathrow, Lord Hailsham, the minister of science, said the government is not satisfied that the solution at Heathrow justifies adoption of this recommendation and that he believed it would be impossible to limit grants to houses near airports

Austrian Load Figures

Vienna—Austrian Airlines' preliminary results show gains of 15% in ton/mi sold 16 8% in passengers carried 27 7% in freight/tons and 25 3% in mail carried during the first half of 1963 over the same period last year

Ton/mi sold totaled 3,696,260 as compared with 3,213,705 ton/mi during the first six months of 1962 Passengers carried were 76,264 freight totaled 443 5 U S tons and mail 190 5 U S tons during the first half of this year as compared with totals of 65,290 passengers 347 3 tons of freight and 152 tons of mail for the 1962 period

What is a fan-jet?

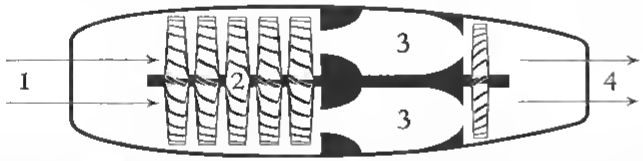
The American Airlines fan-jet story

A jet is propelled by the thrust of its engines.

But this thrust comes from a very hot exhaust, and hot air is thin air–a little like a lightweight's punch.

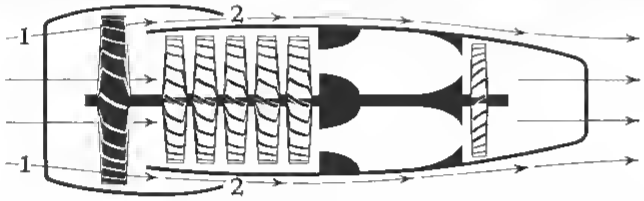
The fan-jet makes a sort of heavyweight out of it.

This engine, which American Airlines helped develop, takes



[Above] Ordinary jet draws air in the front [1], compresses it [2] and heats it in a burner chamber [3]. This expands it and it shoots out the back as exhaust [4]

[Below] Fan-jet draws in extra air through an enlarged inlet [1] This extra air is partly compressed [2] Then, still cool it shoots through side exits as extra exhaust, giving extra power to the plane.



in twice as much air as ordinary jets and gives the thrust twice as much body. The result is 30% extra power–so much that the plane itself had to be changed.

This was the birth of our first Astrojet in 1961.

Astrojets take off and climb faster, fly more quietly, and use the fan-jet's extra power to help get you in on time.

Only 2 airlines in the U.S. have fan-jets on every jet they fly. American and Western.

American has 64 fan-jets, 41 more than any other airline.

Caravelle Super A Takeoff Performance Shown

Takeoff performance of the Sud Caravelle Super A transport, powered by General Electric CJ805 23C turbofan engines, is demonstrated at Le Bourget Airport during the Paris Air Show (above). At a maximum gross weight of 114,640 lb., the airplane, with its double slotted flaps extended 10 deg., requires 6,080 ft. for takeoff. The lightly loaded airplane at Paris was able to improve on this performance as indicated by the steep climb after breaking ground and by the amount of runway remaining. Note glove on leading edge of wings at the roots (AW June 10, p. 48). As the Caravelle Super A waits at the end of the runway (below), the de Havilland Trident, powered by three Rolls-Royce Spey turbofan engines starts a low level pass over Le Bourget

AERIAL VIEW OF O'HARE from west shows terminal complex and 5,700 car parking lot. Present terminal buildings and circular restaurant are at right. International arrivals building (left) is being completed. International passengers now arrive at low, shed-like building at far left. Terminal has five fingers, with one still under construction. Heating and refrigeration plant building is at the parking entrance and buildings in upper right house cargo facilities.

Major U. S. Airports—Part 5:

O'Hare Walking Distance Stirs Criticism

By Robert H. Cook

Chicago—Chicago-O'Hare International Airport, the most heavily used air terminal in the world, is caught in a purgatory of its own creation.

Management's pride in O'Hare's efficient handling of traffic volume that would overwhelm almost any other terminal is being severely wounded by the continuing public clamor to "do something" about the walking distance at O'Hare, designed as one of the first, finest and largest terminals to serve the public in the jet age.

And the problem will undoubtedly grow worse as traffic continues to increase. Last year O'Hare handled 13,298,710 passengers, and for the first four months of this year recorded a 17.4% gain with 4,713,196 passengers. This annual total is about 10% more than that of New York International Airport and twice that of the Los Angeles International Airport.

Thus, it seems that the primary reason O'Hare's finger design is too often singled out for criticism is that the terminal is used by more people than any in the world. Its exposure to criticism is therefore higher and complaints can be expected to increase in proportion to traffic gains.

Ironically, O'Hare's designers suggested a novel way to avert this problem, but were silenced by the objections of the airlines. The designers first choice was a central terminal building with mobile lounge transportation to the aircraft, to cut down walking distance.

This was rejected by the carriers on the theory that it would only complicate the walking problem for interchange passengers. Today, a local service airline passenger transferring to a trunkline may walk anywhere from ¼ to ¾ mi. in making a transfer, unless the local and trunk carriers are located in the same finger system—such as North Central and Lake Central, which are in the same Y-shaped finger as Delta and American Airlines.

A second choice for a design similar to the Los Angeles satellite building system was almost accepted, but finally was rejected on grounds that it failed to provide sufficient space for airline operations offices.

O'Hares' management is aware of this problem, but finding an acceptable solution is hampered by the high costs involved. Installation of moving sidewalks through the terminal's five fingers, some of which are two city blocks long, could cost an estimated $5 million and maintenance costs alone would approximate $300,000 a year.

The airport also has explored the use of passenger cars propelled by a moving belt to connect its two present terminal buildings with a new international terminal now under construction.

In any event, the cost of any approved modification will be passed on to the airlines, in the form of increased landing rates, or to the concessionaires.

Financially, O'Hare's explosive traffic growth has justified the close support of the airlines and produced a high degree of fiscal stability for the airport. The airlines underwrote the $140 million in revenue bonds required for construction of the 7,200-acre facility. As part of the joint agreement, the airlines have a sliding scale landing fee designed to cover bond principal and interest payments, whether traffic is high or low. The fees are reviewed each six months, and have fluctuated all the way from 7 cents to $1.28. After retirement of the total bond issue, these fees will be changed to cover only the airport's actual operating expenses.

Because of the steady increase in O'Hare's traffic volume, amortization scheduled on the bond issue has been reduced from the original 40 years to only 27 years.

As O'Hare handles only a small number of international flights, a bus meets each flight and delivers passengers to

Three United Boeing 727s Await Flight Test

Three United Air Lines Boeing 727 jetliners are shown on the preflight line at the Renton, Wash., Municipal Airport, prior to making their first flights. First four 727s are undergoing flight tests at Boeing Field in Seattle, and have logged nearly 300 flight hours. First 727 deliveries are scheduled for later this year.

the desired terminal building. Cost is 25 cents. O'Hare's one attempt to provide free bus transportation from the outer extremity of the 5,000-car parking lot drew numerous complaints. The cost ran about $8,000, and the service was eliminated after a closer area of the lot was completed. Future expansion plans call for the double-decking of the south portion of the parking lot. Parking volume now reaches 7,000 cars per day.

Because of its sprawling layout, O'Hare has concentrated its best dining facilities in a separate circular building located between the two terminal buildings. This can pose a timing problem for the travelers, since it involves a possible maximum walking distance of up to four city blocks to the departure gate of almost all airlines, with the exception of United and Trans World Airlines. Veteran airline passengers often prefer a less sumptuous meal at one of the small bars in the terminal buildings or in the fingers.

However, there is no doubt that the airport has catered to the passengers' needs whenever possible. Its terminal buildings can fill nearly every conceivable need, including fully equipped nurseries where infants may be changed, clothed and even fed from a completely equipped kitchen.

Complaints about cab drivers refusing to accept short-haul fares within the airport area have also been solved. Drivers accepting such fares now are given a special card which returns them to their former position in the cab line after completing a short haul trip.

Public complaints over aircraft noise have dropped considerably through increasing use of turbofan equipment and a land acquisition and zoning program which has provided O'Hare with an extensive buffer zone between it and surrounding communities. About 1,500 acres have been added to the airport in the past year, primarily for runway extension programs now under way or planned. To the north, the acquisition of Ravenswood Airport, a small private field, will provide an adequate approach zone for a planned 4,255 ft. extension to the existing 7,349-ft. Runway 32R-14L. Cost of the project is estimated at $5.6 million. To the west and south, the airport boundaries has been extended up to the Chicago and Northwestern Railway and the Chicago, Milwaukee, St. Paul and Pacific railroad lines. To the east, the property line generally follows the Tri-State Toll Highway and the Minneapolis, St. Paul and Sault Saint Marie Railroad.

In addition to Runway 32R, O'Hare has 32L-14R which is 11,600 ft. long, 27R-9L at 7,400 ft., 22-4 at 7,500 ft. and 36-18, 5,500 ft. All except the latter two have instrument landing systems.

Before the end of this year, bids may be let for a sixth runway oriented in an east-west direction. It will be designated Runway 9R-27L, and will be 10,300 ft. long. Cost will be approximately $6 million. The airport's master plan also call for a $3-million overpass taxiway this year to permit bridging of the Northwest Expressway to connect the terminal ramp area with the taxiways of Runways 27R and 32R.

Construction of the new international terminal building should also be finished this year. About $2 million is being expended to bring the face of the original building flush with the terminal entrance roadway. An existing single finger to the north of the new building will be retained for international departures. International arrivals are now being handled in an old Quonset-type building just beyond this finger.

Relocation of O'Hare's traffic control tower is also planned for the near future. The present tower is located atop the Concourse D finger between the new international building and terminal building 2. It will be relocated on the parking lot area directly across the entrance to this terminal building for a better surveillance of the field area.

Cargo handling facilities will also be expanded this year with the addition of two new cargo buildings. The new cargo area is on the east side of the terminal.

O'Hare's traffic acceptance rate is about 62 aircraft per hr., but it has recorded days where more than 100 arrivals and departures have been made in 1 hr. To prevent any ramp clutter which could impede this acceptance rate, most of O'Hare's management and supervisory personnel are equipped with portable two-way radios used to coordinate a smooth flow of ground traffic.

Much of the airport's success in handling ground traffic must be accredited to its remote-control fueling system which virtually eliminates the need of fueling trucks to mingle with the parked aircraft. A 16-tank, 5-million gallon fuel farm is located on the western perimeter of the ramp, and is connected to five "satellite" pumping stations serving each of the finger complexes. Fuel flow to these stations, plus the individual aircraft fueling hydrants, is controlled from the fuel farm center.

In the wake of O'Hare's growth the old Midway Airport has virtually been abandoned with the exception of non-scheduled airlines and general aviation flights. Contracts still in effect for most of the former scheduled users of Midway are due to expire next year, and there are no concrete plans to refurbish the facility any more than is necessary for its current use. Once known as the world's busiest airport, Midway handled only 659,000 passengers last year, with more than half of this total accounted for by non-scheduled and general aviation carriers. Passengers in the latter categories continued to increase this year, even as the scheduled airline passengers decreased. For April, the total passengers handled were 35,248. Scheduled airline passengers accounted for only 3,396 of this total.

(The sixth article in this series on major U.S. air terminals will be a report on New York International Airport. It will appear in a subsequent issue.)

SHORTLINES

► **Alitalia** and Marco Polo Tours, a travel agency, have sold 26,000-mi round the world trips to 595 members of the Watch Tower Bible and Tract Society at a total cost of $1,445,965. Tour will involve 57 scheduled airlines, 200 hotels and numerous bus and tram lines. Tour will take six months and will cover 28 cities in 23 countries.

► **American Airlines** reported a 13% gain in revenue passenger miles in June compared with June, 1962. Carrier attributed the increase to "strength in the general economy" and "the effect of promotional fares" on sales.

► **Continental Air Lines** today completed the transfer of its headquarters to Los Angeles after more than 25 years in Denver. Total of 235 members of the airline's executive and administrative staffs moved into the company's new $2 million building at Los Angeles International Airport.

► **Flying Tiger Line** says its experimental program of flying consolidated shipments of parcel post between Los Angeles and four eastern markets has generated an additional 1 million lb. of new airfreight business during the six months the program has been in operation.

► **U.S. Commerce Dept.** has reduced the guarantee fee for the Aircraft Loan Guarantee program from 3.75% to 2.5%.

► **Delta Air Lines** will begin Convair 880 service into Jackson, Miss., in October, giving Mississippi the state's first jet service.

► **Pan American World Airways** has reported a record 31% increase in the number of passengers carried on its North Atlantic route during the first 23 days of June compared with the same period last year.

► **Sprague Engineering Corp.** will install jet fuel test equipment and maintenance facilities at Addis Ababa airport under a contract to TWA for Ethiopian Airlines. TWA provides management assistance to the African carrier.

► **Trans World Airlines** has reported a 3.7% increase in revenue passenger miles flown in June compared with the same period last year. International revenue passenger miles climbed 4.0% in June, while domestic traffic rose 3.6%.

AIRLINE OBSERVER

► Decision may be made soon by General Dynamics/Convair on whether to build a small, short-to-medium range transport designed as a replacement for the Convair 240, 340, 440 series and for other twin engine transports. Engineering studies are under way at San Diego and market surveys have been in progress. The airplane would have twin turbojet engines mounted at the tail. It would be smaller and lower priced than the Douglas DC-9, BAC 111 or other, larger competitors for the short haul market and would carry 44 passengers—more nearly approximating an Eastern Air Lines requirement for a 60,000-lb. gross weight airplane (AW Nov. 6, 1961, p. 41). Approximately 1,050 of the Convair 240 series aircraft are in operation, about half of them in commercial use and the balance in military service.

► **International Air Transport Assn.** Traffic Conference role in rate-making may be weakened by the assumption by governments of more jurisdiction over international fares after this week's meeting of 25 governments in Ottawa. The meeting was convened at the invitation of the Canadian government's Air Transport Board, and is expected to review closely IATA's unanimity rule, considered by many to be the main block to lower fares.

► Pan American World Airways' plan to extend its present thrift fare between New York and Puerto Rico to Europe and Hawaii (AW July 1, p. 37) is a reversal of historic airline tariff structures calling for a reduction in rate per mile as stage length increases. Pan American's fare per mile on the New York-Puerto Rico route is about 3.6 cents. Under the proposed thrift plan rate will be about 4 cents per mile on the longer West Coast-Hawaii route and 4.5 cents per mile on the still longer transcontinental route.

► **Italians rejected a direct offer from the U.S. for an extension of its routes to Los Angeles because of Italy's unwillingness to accept the condition that traffic statistics be exchanged between the two countries. European countries have tacitly agreed to balk at U.S. demands for the reciprocal trade of such figures.**

► Cunard Eagle Airways, the British independent airline, has bought five of the 14 Bristol Britannia 312 turboprop transports phased out of service by British Overseas Airways Corp. The airline has also formed a technical team to evaluate the Vickers Super VC-10 four-jet transport. Meanwhile, Communist China has ended negotiations with BOAC for five 312s.

► **Iraqi Airways is sending a delegation this month to the U.S. and Britain to select transport planes for expansion of the carrier's operations. The group will study the entire spectrum of medium-range transports.**

► British Air Registration Board has submitted a report to the Ministry of Aviation on much-criticized pilot procedures for noise abatement at London Heathrow Airport (see p. 41), after extensive tests using Boeing 707s and de Havilland Comet transports. Gist of the report by ARB Chief Pilot A. D. Davies, which has not yet been made public, is that existing regulations are safe but some modifications are needed.

► **Civil Aeronautics Board Examiner Robert L. Park, in an initial decision, found that the tariff filed by American Airlines calling for reduced fares for former employes is unjustly discriminatory and unlawful. American requested the fare for use of members of the Kiwi Club, former stewardesses, and Grey Eagle Club, former pilots, in flying to and from club conventions.**

► Pan American World Airways and the Brotherhood of Railway Clerks last week signed an agreement providing for final and binding arbitration in any dispute when the machinery of the Railway Labor Act has been exhausted.

► **United Aircraft Corp.** air cargo shipments during 1962 totaled 9 million lb., or 4.5% of all available tonnage moved by the manufacturer. According to Interstate Commerce Commission's Bureau of Transport Economics and Statistics, less than 0.05% of all freight moved in the U.S. is shipped by air. Statistics apply only to cargo readily transportable by air and do not include such commodities as fuel or building materials.

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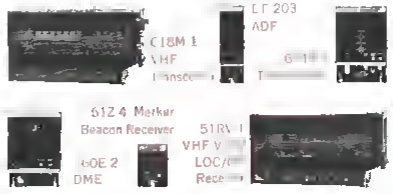

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COLLINS

Detail of this week's cover photograph shot from another angle shows Thunderbirds making close crossover with one F-100 inverted

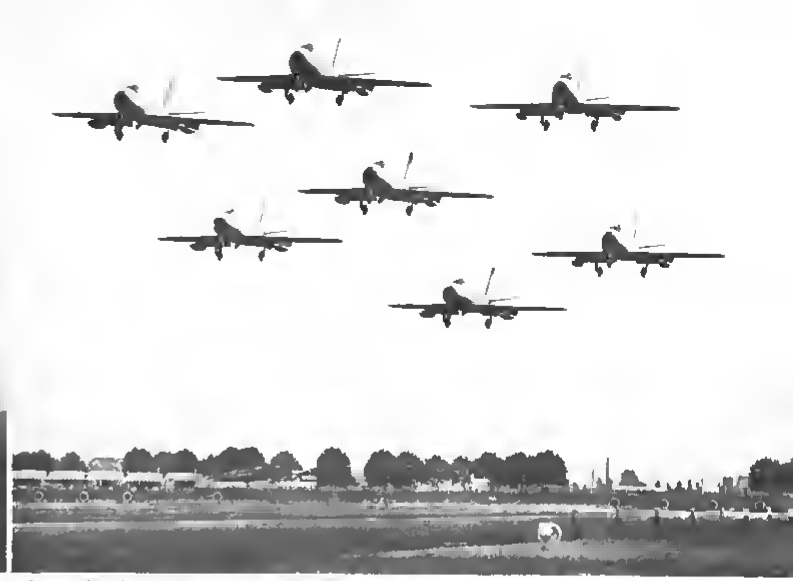
Formation aerobatics by four-plane elements, above show afterburner use (left) and changing places in formation (right). Below, two Thunderbirds make extremely low level high speed crossovers down Le Bourget runway with afterburners on

Thunderbirds Introduce New Maneuvers at Paris

USAF Thunderbirds aerobatic team performed on both of the final flying days of the 25th Paris Air Show at Le Bourget introducing several maneuvers that were new to European audiences. The Thunderbirds flying North American F-100C Super Sabres, worked in two elements: one a four-plane formation that executed precision aerobatics while changing its formations; the other two solo planes that filled the intervals between the formation maneuvers with a variety of extremely close low-level crossovers. The Thunderbirds used afterburner bursts during their maneuvers and trailed red, white and blue smoke in formation loops and some crossover patterns.

Sequence, this page, shows Thunderbirds making low level pass, then breaking into loops in opposite directions. Bottom, smoke trails show low level approach as F-100s begin climb into loop. Two top photos show inverted breakaways off top of loops

Aerobatic team of Royal Hellenic Air Force is shown in formation takeoff with their F-86 Sabres from wavy runway at Le Bourget.



Greek F-86 aerobatic team is shown making formation approach to landing with gear and flaps down just over the end of the runway.

Greek Air Force Team Displays Precision Formations in First Appearance at Paris

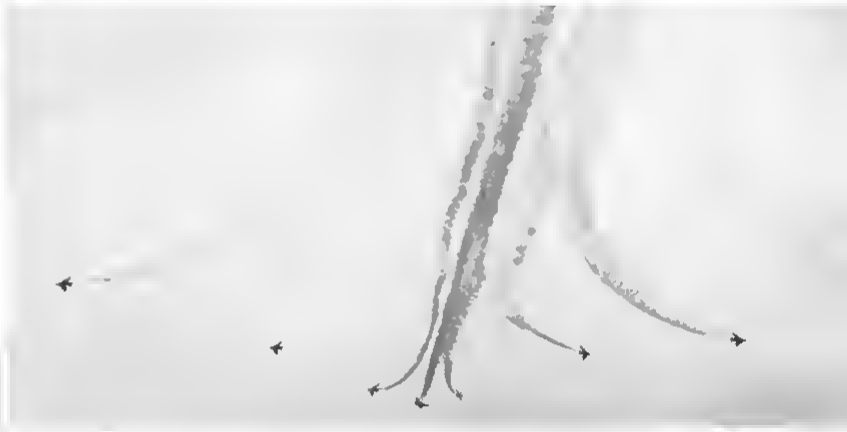
Greek air force aerobatic team displays precise formations with arrowhead (left) and box of diamonds (right)

Seven plane formation landing is shown just before touchdown with rear plane landing first and lead plane last to touch down

Italian air force aerobatic team performed one of the most spectacular maneuvers of the 25th Paris Air Show with the two outer wing men in a Vee formation rolling (above). Note F-86 at right starting roll.

Italian Display Features Double Bomb Burst

Nine-plane Italian air force aerobatic team makes low level slow formation pass down runway streaming red, white and green smoke.



Spectacular beginning of the Italian nine-plane double bomb burst (AW June 24, p. 31) is shown with the initial downward breakaway (top and middle). Eight planes later reconverged for upward bomb burst with moth plane rolling upward through the formation. Lower picture shows bottom of formation loop.

First Gemini Computer Model Completed

By Roderick D Hibben

Owego, N Y—International Business Machines Corp has shipped the first engineering breadboard model of the Gemini spacecraft computer, a key subsystem in Gemini's rendezvous and docking missions, to McDonnell Aircraft Corp

IBM Federal Systems Div 's Space Guidance Center designed and built the computer for McDonnell under a $24-million contract for the inertial guidance system The subcontract called for 11 spacecraft installations and two spares.

Digital computer is the heart of a complex inertial guidance system This system will accomplish the central goal of Gemini rendezvous and docking of a manned spacecraft with an Agena D

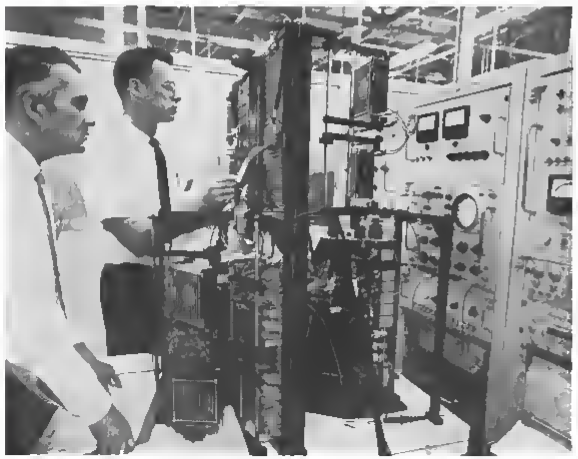
Astronauts will navigate from visually displayed commands provided by the computer, which will implement Gemini mission flexibility by giving the crew complete attitude and abort control of the spacecraft during each mission mode (AW May 13, p 53).

The computer will be used as a primary or back-up system in the following mission modes

- **Ascent,** the period from launch through orbit insertion of the spacecraft
- **Rendezvous,** the period from orbit insertion through fast and slow catch up sub-modes, the chase, which precedes docking
- **Orbit navigation,** the period in which spacecraft orbital parameters are being obtained prior to selection of a preferred landing site
- **Re-entry,** the period of controlled descent following retrofire

The inertial guidance system, of which the computer is a part, backs up the radio command unit, during ascent The astronauts can decide to switch to the inertial guidance back-up unit at any time during ascent should the flight needles, which indicate pitch and yaw, drift excessively from the neutral position Depending on the drift rate, the astronauts would normally refer then drift rate with the ground control station before switching to the inertial guidance system

A malfunction detection system, consisting of a set of redundant sensors, monitors combustion chamber and tank pressures in both stages and turning rates along pitch roll and yaw axes, separation of first and second stage and bus voltages (AW Sept 3 p 38) It automatically transfers control of the spacecraft from the radio command unit to the inertial guidance system in the event of a sudden primary system failure



FIRST PRODUCTION PROTOTYPE of Gemini spacecraft computer is shown, lower right, surrounded by special fixture which allows buildup and test of circuits prior to soldering them into back panel

During ascent, until booster engine cut-off, the computer is operating in an open loop mode In open loop, it gives automatic guidance and control commands, but doesn't feedback to correct them. The computer calculates the launch azimuth angle, target plane, spacecraft position and velocity Spacecraft position and velocity are read out every 0 5 sec The computer gives preprogramed steering commands for vehicle roll, then the pitch necessary to conclude the open loop part of the ascent

Closed Loop Operation

Shortly after first stage burnout, closed loop computer operation of the ascent begins. Using explicit guidance equations, the computer issues steering commands following second stage ignition

Ground control sends velocity updates which the computer uses to refine guidance errors

After maximum Q, the condition of highest dynamic pressure, the Gemini launch vehicle autopilot gain is adjusted by the computer Second stage engine cutoff for orbit insertion is controlled by the computer which then calculates the spacecraft thrust for refinement of its orbit insertion attitude Orbit insertion completes the transition from an ascent to a chase mode.

Rendezvous includes two sub-modes fast catch up and slow catch up

After a correct orbit insertion attitude has been established, the mode switch is turned to the fast catch up sub-mode At this time, the Gemini capsule lags the Agena D target vehicle by 10 70 deg as measured between each spacecraft's longitudinal axis Gross angular corrections of 5.3 deg/orbit are then made until the lagging angle is about 10 deg Target and spacecraft orbital parameters monitored on the ground are sent to the computer when the lagging angle approaches 10 deg

Velocity Changes

Ground computers determine necessary incremental velocity changes and thrusting time for rendezvous Communication to Gemini from the ground is by voice or an on-board digital command system which accepts binary coded messages at 1 kc

Decision whether or not to rendezvous is made in the fast catch up sub mode Decision is based on a favorable fuel requirement, since the astronauts have a thrusting budget they must abide by If the fuel requirements for rendezvous calculated by the computer are excessive, the astronauts must wait

If the decision to rendezvous is made, the astronauts will insert incremental velocity changes and thrust time obtained from the ground control station into the manual data keyboard which is part of a manual data insertion unit This unit also contains a manual data readout which verifies information being inserted into the computer as well as telling the astronauts information contained in the computer memory An elapsed time indicator provides a thrust time reference for rendezvous to the crew

The astronauts align the spacecraft to the proper orbit plane by driving three visually displayed gimbal angle outputs from an inertial measuring unit to zero When nulling of the displayed gimbal angles is completed, the astronauts press a computation start button which activates the computer and an incremental velocity indicator tells the crew what thrust changes must be made in the three velocity axes of the Gemini capsule to further refine the spacecraft alignment for rendezvous

When the phase angle between the spacecraft and target vehicle is about 10 deg., the slow catch up sub-mode begins and smaller alignment corrections of about 1 3 deg orbit are made until the lag angle is about 3 deg

Radar Lock-on

Radar lock-on occurs at a maximum range of 250 mi (AW Oct 22, p 72) activating a red light Radar generates a bit pattern input to the computer, which changes at lock on closing the red light circuit Mode switch is then put in the rendezvous position

Radar data points are fed into the computer every 100 sec A total of 24 readings are obtained in the open loop part of rendezvous The computer translates the radar points from digital form into incremental velocity changes—in the three spacecraft axes—required for rendezvous and displays them for the astronauts

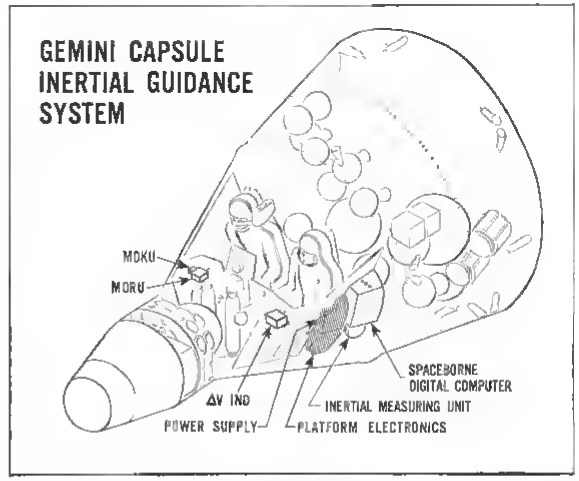
The velocity changes displayed are calculated using the first eight and the numbers 19 and 20 radar points

At this time velocity changes to rendezvous would be about 200 ft/sec or less The astronauts would then press the computation start button to initiate the closed loop portion of the rendezvous

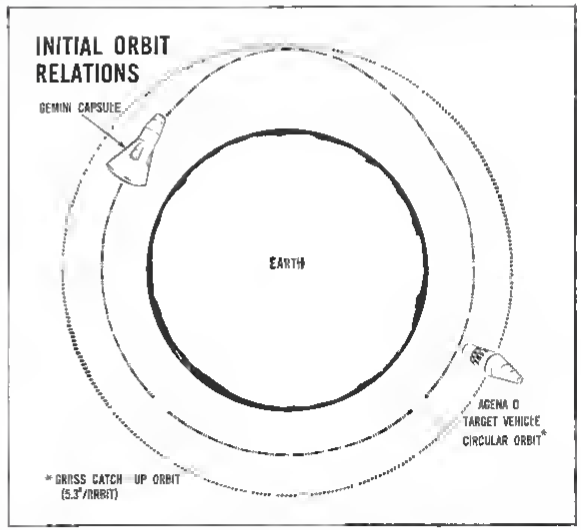
Closed loop operation would take 67 min 30 sec and would be accomplished within 270 deg of orbital travel Radar points are supplied to the computer every 50 sec until impact Attitude and incremental velocity changes would be made every 60 deg by the crew Within 30 deg of impact, the crew would make the last guidance corrections

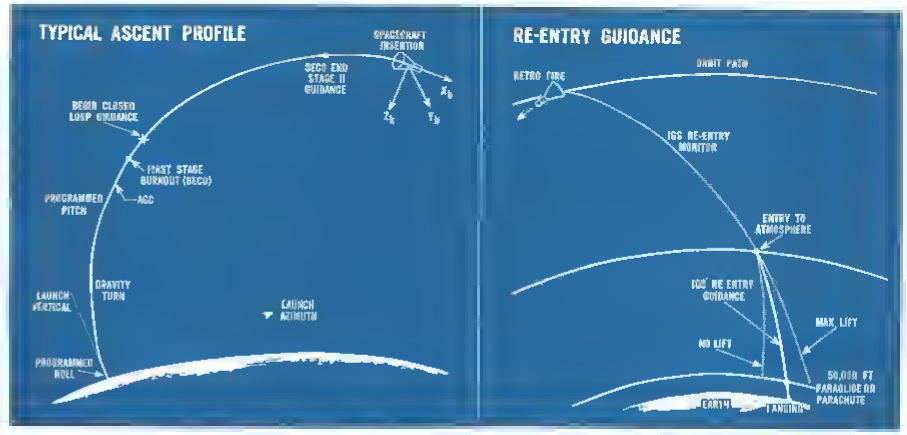
The computer display board would then become a flight instrument When the incremental velocity indicator displays stop, the astronauts regulate thrust to correct the errors Spacecraft attitude errors are corrected similarly After the astronauts have obtained a series of seven radar points following thrusting, they will use the gyro compass for reference alignment of the space platform

Attitude and velocity errors are corrected using a fade-in technique This technique involves making a series of corrections starting first with gross corrections then smaller and smaller corrections Errors in attitude and velocity



GEMINI COMPUTER'S manual data keyboard unit (MDKU) and manual data readout unit (MDRU) positions are shown, above Initial orbit positions of Agena D and Gemini, below, presume 10 70 deg trailing angle between longitudinal axes Variable launch azimuth capability of Gemini allows some degree of flexibility in rendezvous plan.





PROGRAMED ROLL. left is initiated 5-20 sec after liftoff. Launch vehicle has 20-deg roll capability clockwise or counterclockwise. Attitude guidance control (AGC) follows programed pitch command. No lift condition during re entry, right, corresponds to 20 deg/sec roll rate. Roll is begun at about 60,000 ft. Spacecraft re-enters atmosphere at 400,000 ft.

are reduced at each 60 deg. of the final rendezvous trajectory until impact.

An automatic braking schedule past 30 deg. from impact on the rendezvous trajectory calls for the closing range rate indicated by radar to be monitored visually by the crew. Visual navigation of the spacecraft would precede docking with the Agena D.

Orbit navigation capability of the Gemini spacecraft depends on getting ground updates of position once every three orbits. Less frequent updates would result in bigger errors which the computer must then correct.

Primary guidance and control system for re-entry is entirely automatic. Re-entry sequence would begin with warmup of the space platform, which takes 60 min. Thermal equipment includes fast and slow heat elements. Investigations currently are under way to determine what design sacrifices must be made to reduce warmup time. Use of the gyro compass to align the space platform follows warmup. Space platform must be within 5 deg. of perpendicular drawn from earth's center to the platform in order for the astronaut to gyro compass.

The computer requires a 1 min warmup, but is turned on 15 min before retrograde time to obtain continuous updating of re-entry parameters.

During re entry the computer calculates:

- Thrust and thrusting time.
- Re-entry errors due to thrust errors.
- Point of entry into atmosphere.
- Down range and cross range errors.
- Spacecraft roll necessary to achieve target.

Velocity and position information is displayed to the crew down to 400,000 ft without computer guidance. Computer functions are restricted to issuing navigational information in this part of the descent. From 400,000 ft, a controlled trajectory is planned using the inertial guidance system.

Optimum trajectory is intermediate between a zero and maximum lift condition. Automatic guidance commands provide bank angle and roll rates to alter the capsule's lift vector (see drawing above). If range to touchdown with zero lift is equal to or greater than the computed range, a programed constant roll rate of 20 deg/sec—3.3 rpm—would be initiated by computer command.

If overshoot of the spacecraft should occur, an alternate mode of the automatic guidance system would break its link to the computer, activating a red light indicating a down range error. The guidance system would correct the overshoot by putting the spacecraft in a no lift trajectory. Cross range errors would be displayed similarly.

Landing footprint at 100,000 ft will be an area about 400 mi long and 80 mi wide. Re entry target is expected to be Corpus Christi, Tex.

The computer termed "The most advanced computer we have built" by Harry F. Branning, Gemini systems integration manager at IBM, weighs 57.6 lb, occupies 1.4 cu ft and requires an average of 94.54 w power.

The computer is designated as a general purpose binary and serial with a fixed point arithmetic operation. Basic element of the random access, non destructive advanced memory is a two hole ferrite core developed at IBM. Non-destructive core feature of the memory saves power and need for added instrumentation, IBM said.

The computer memory is constructed by stacking 39 planes, each consisting of a 64 x 64 array of cores. Total memory capacity is 4,096 words of 39 bits per word or 159,744 total bits. Syllables are 13 bits in length with three syllables in series making up one memory word. An instruction word corresponds to one syllable, while a data word can be one or two syllables.

Division between instruction and

Gemini Emergency Abort

Feasibility of two emergency abort modes resulted from IBM's Gemini orbit navigation studies. In the first mode the astronauts would plot their ground path, select a preferred landing site and determine retrograde time from ephemerus calculations. Ephemerus calculations would provide a chronological tabulation of the spacecraft's position—considered as a celestial body—at regular time intervals. Landing at a preferred site within one orbit was required in the first mode.

Second emergency mode was automatic with the radio command unit issuing retrograde time instructions for re entry. Semi-optical tracking technique employed by the ground station would establish the spacecraft orbital parameters to target at landing site. Astronauts would have the option to decide when to go. Further investigations on the re programming of the computer in orbit are planned to estimate the flexibility of the second escape mode.

Emergency abort technique for Gemini will be selected from the more flexible of the two modes.

data storage in the memory unit permits flexible operation of the computer.

Basic computer clock rate is 8 mc which is used to convert platform gimbal angles from analog to digital form. Four pulses are generated from the 8 mc clock rate to provide the reference timing for all of the other computer circuits.

The arithmetic bit rate operates at 500 kc and the memory cycle rate is 250 kc. Adding, subtracting and transferring of information takes 140 microsec.

Full precision multiplication and division require 420 and 840 microsec., respectively.

All arithmetic operations can be programed concurrently.

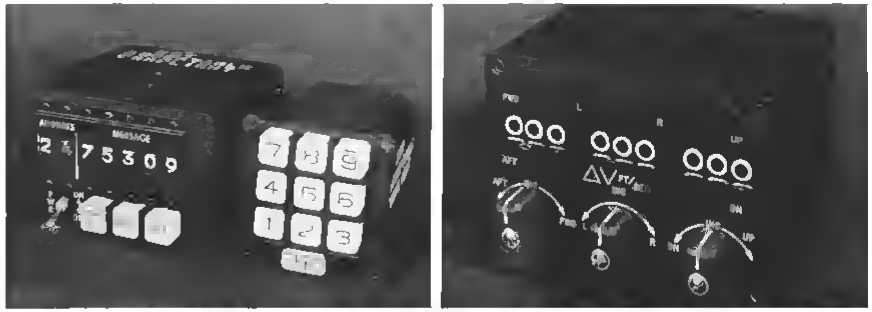
Mission reliability of the computer—the mean operating time between failures in orbit—is 2,560 hr.

A diagnostic subroutine is built into the computer to detect malfunctions during operation. When a malfunction occurs, a discrete output sent by the computer activates a light on the astronaut's control panel. The discrete circuit has a manual reset capability to

Computer Characteristics

Inputs	No
Discretes	48
Incremental velocity channels	3
Gimbal angle channels	3
High speed (500 kc) data channels	2
Low speed (3.57 kc) data channel	1
Low-speed (182 bits/sec) data channel	1
Input and readback channel (99 words)	1
D.C. power (4 regulated)	5
A.C. power (regulated)	1
Outputs	
Discretes	30
Steering command channels	3
Incremental velocity channels	3
Decimal display (7 digits)	1
Telemetry channel (21 digital data words)	1
Low-speed (3.57 kc) data channel	1
Low speed (182 bits/sec) data channel	1
Regulated d.c. power	3
A.C. power, regulated (filtered)	1

Memory Allocation	No. of words
Prelaunch	80
Ascent guidance	2,990
Catch-up/rendezvous	2,625
Orbit navigation and re-entry	4,000
Manual insert and display	800
Input/output	1,125
Common subroutines	655
Total	12,175
Total available	12,288



MANUAL DATA INSERTION UNIT. left photo, is composed of manual data readout (extreme left) and manual data keyboard. Unit allows astronaut to communicate with computer. Incremental velocity indicator, right photo, reads 0.999 ft./sec. changes in three spacecraft axes

insure that it was not lighted by a transient type malfunction.

The computer is controlled with four switches located on the astronaut's control panel.

The switches are:

- **Seven-position computer mode switch.**
- **Two-position computer off-on switch.**
- **Push-button start computation switch.**
- **Push-button malfunction reset switch.**

Transients in the prime spacecraft power source are buffered by a regulated d-c power from the inertial guidance power supply. Regulated a-c and d-c from the inertial guidance system power supply run the computer. Power interruptions and depressions of up to 30 millisec. and 10 millisec., respectively, can be tolerated by the computer.

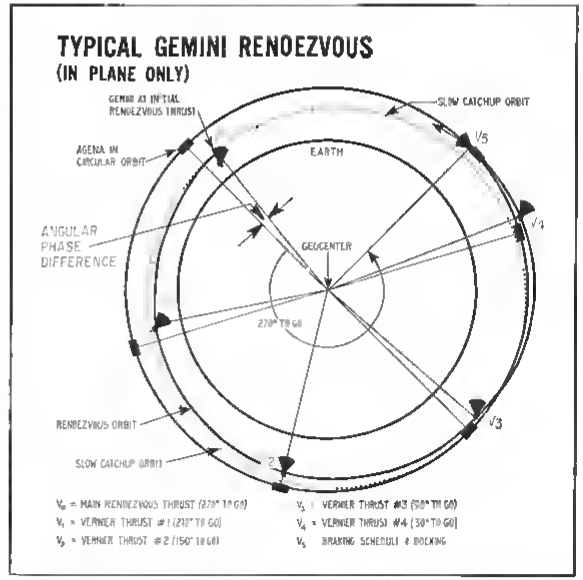
The inertial guidance system occupies 3.1 cu. ft., weighs 177.78 lb. and needs 444.8 w., almost 20% of Gemini's primary power.

Information flows from the computer to the following units of the inertial guidance system:

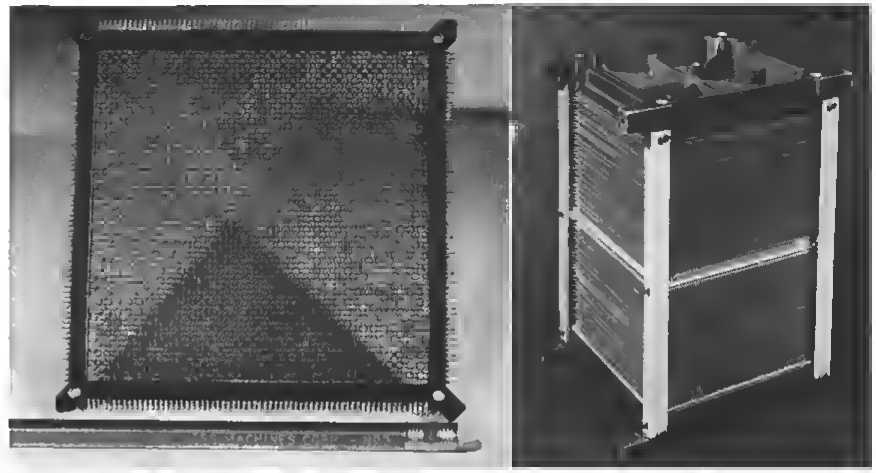
- **Inertial platform**—Computer supplies a 400 cps. excitation signal to three resolvers located on the pitch, outer roll and yaw gimbal axes of the platform. Movement of the rotors of any of the resolvers away from their zero position—platform caged position—causes the output voltage of the stator windings on each gimbal axis to be phase shifted relative to the reference 400 cps. excitation. Each gimbal resolver supplies two cps. voltage inputs to the computer.
- **Platform electronics**—Outputs from each of three platform accelerometers are supplied as incremental velocity pulses on two input lines to the computer.
- **Manual data insertion unit**—This unit can insert into and display up to 99 data words from the computer. Keyboard of the manual data insertion unit has 10 push buttons and the astronauts will have to insert seven digits to obtain information from the computer. The first two digits address the computer and the following five feed in data.

If the operator should insert in request readback of an invalid address, insert more than seven digits or fail to insert an address prior to depressing the insert or readback button, the seven digits displayed will be all zeros to indicate astronaut error.

- **Rendezvous radar**—Computer receives line of sight range to target, sine of elevation and azimuthal angles within a 25-deg. maximum cone, or radar line of sight relative to the spacecraft axes. Gemini is navigated using two coordinate systems—a platform and a spacecraft reference axis. The rendezvous radar sends computer data in the spacecraft axes. The computer must translate all position and attitude information into platform coordinates except attitude changes to be made with the cap-



SLOW CATCHUP ORBIT following fast catchup in Gemini rendezvous mode provides refined alignment of spacecraft and target vehicle when angular phase difference between the two is 10 deg. or less. Complex rendezvous trajectory is three-dimensional. Spacecraft is expected to pass through many planes before targeting with Agena D.



MEMORY PLANE, left, is one of 39 utilized in random-access, non-destructive advance memory for Gemini computer. Plane consists of 4,096 multi-apertured reluctance switches. Switch is similar to a classic transfluxor, in that it is composed of square loop magnetic material embodying two apertures. Memory array, right, is stack of 39 memory planes making up RANDAM system for Gemini computer. Array is shown prior to interconnection of individual planes for addressing and sensing.

Gemini Rendezvous

For the rendezvous mission, the Agena D will be launched into a circular orbit of 150 naut. mi.

Initially, the Gemini spacecraft would have an elliptical orbit with an apogee of 150 naut. mi. and a perigee of 80 naut. mi.

Rendezvous thrusting in the slow catch-up mode would increase the perigee to 133 naut. mi., making it an almost circular orbit.

Normal rendezvous between the spacecraft will require that their orbits be coplanar within a degree. Out-of-plane corrections exceeding this can be tolerated at the expense of more fuel. An angular phase difference (see drawing p. 59) of 10.70 deg. between spacecraft is typical. Period of the Gemini spacecraft's lower elliptical orbit is less than the target vehicle's, allowing the angular phase difference to be made up with no expenditure of fuel except for velocity changes.

Gemini mission flexibility is provided in the rendezvous mode by alternate guidance systems. Rendezvous can be accomplished by either semi-optical guidance using ground tracking station techniques or orbital mechanical guidance using the inertial guidance system.

Capability of both systems will be evaluated individually rather than considering one a primary and the other a back-up system.

sule thrusters which remain in spacecraft coordinates.

Inertial guidance system unit contractors are Advanced Technology Laboratory, horizon sensors Lear Siegler, attitude display group, Westinghouse, rendezvous radar Honeywell, inertial measuring unit, and Engineered Magnetics power supply.

Honeywell and IBM share over-all performance responsibility for the inertial guidance system.

Chief difficulty in the computer design once weight and power requirements were met, was incorporating state-of-the-art advances in materials and construction techniques into the production prototypes, IBM says.

Saturn 5 Test Stand Nearing Completion

Construction of the Saturn 5 booster static test stand is nearing completion at Marshall Space Flight Center, Huntsville, Ala. The Saturn booster consists of five Rocketdyne F-1 engines designed to generate 7.5 million lb. thrust.

Completion of the test stand, center of the new 530 million west test area is scheduled for next year. First booster captive test, probably with only one engine, is scheduled for late summer or early fall of 1964.

The test stand, which is 405 ft. high, consists of three sections:

- **First section** is four 144-ft.-high hollow concrete legs. Offices, shops and instrumentation rooms will be built within the legs. The hollow legs, having walls 4 ft. thick, are 47 ft. square at the base and 30 ft. square at the top. Foundation walls for the legs are set into bed rock 40 ft. below the ground.
- **Second section,** a steel superstructure, will extend 122 ft. above the concrete legs to a height of 266 ft.
- **A 200-ton** stiff-leg derrick, with a 135-ft.-long boom, which will be mounted atop the steel superstructure.

The static test stand will hold the S-1C stage in a thrust load platform 120 ft. up from the base of the tower. Four strain gauges located on the platform will measure booster stresses. The stand has a stress capability of up to 12 million lb. thrust. Boosters 170 ft. long with 410-in. dia. can be tested on it.

A water flow of 320,000 gal./min. will be required to cool the 1,700-ton deflector which directs the engine exhaust gases away from the stand. The deflector has 37,273 holes in its upper side to mix the high pressure water with the exhaust plume.

Booster measuring devices will transmit information on 1,200 channels to recording instruments in a blockhouse near the test stand.

General contractor for the Saturn test stand is Ets. Hokin & Galvin, San Francisco, Calif.

This firm also is doing the electrical contracting.

Solid-Rocket Cases

Aerojet-General Corp.'s Structural Materials Div. will build and hydrotest two glass fiber reinforced plastic, solid-propellant rocket motor cases, each measuring 260 in. in diameter and 54 ft long. Case wall will be 1¼ in. thick. The contract, awarded by the Air Force's Aeronautical Systems Div., is for approximately $1 million.

The two cases claimed to be the largest filament-wound units ever built for solid rocket motors, are to be completed in late 1964. Design and materials for the cases will be verified by winding two subscale chambers, 54 in. in diameter and 11 ft. long.

Two full-scale units will be wrapped horizontally on a segmented aluminum mandrel covered with an elastomeric rubber liner needed for hydrotesting. The cases will be cured on the winding machine by means of a hood placed over them after wrapping.

The first of the two full size cases will be tested to destruction. The second will be prepared for shipment to a propellant loading site, indicating that the unit may be loaded and fired some time in the future.

The two 260 in.-dia. chambers and associated hardware will be built and tested under Aerojet supervision at Todd Shipyards Corp., San Pedro, Calif., which offers access to water transportation.

NASA Funds Study Of MSC Local Impact

Detailed study to determine the physical effects National Aeronautics and Space Administration's Manned Spacecraft Center will have on the Houston area when the new Clear Lake site becomes operational next year is being conducted by Southwest Research Institute under a NASA contract.

The study will include three phases that MSC will use in its future planning to ensure good relations with the communities in the Houston area and to determine that its programs will not be adversely affected by local environmental conditions.

The study covers:

- **Documentation** of the current environmental conditions on and adjacent to the site.
- **Prediction** of future developments on the site and in the surrounding area and the effects of their interaction.
- **Recommendations** for a continuous program of monitoring, sampling and testing. These may include such areas as background radiation from radioactive tracer materials, which may be used in MSC testing, and community wide patterns of water and air pollution.

GD/A Satellite to Study Space Phenomena

By Irving Stone

Los Angeles—Satellite for investigating space-environment phenomena is programed for launch into a 500 naut. mi. orbit by General Dynamics/Astronautics from Cape Canaveral in December as a piggyback pod on an Atlas.

Orbital altitude will be attained with an additional boost from a small, jettisonable, solid-propellant rocket motor carried by the 300-lb. satellite.

Satellite will be the first to be fitted with solar cell panels configured as hemispherical domes at the ends of a cylindrical center section of the payload.

Designated SATAR for satellite for aerospace research, the payload will contain about 200 lb. of instrumentation, in addition to the solar panels and associated power conversion equipment. Instrumentation will include magnetometers, radiation detectors, biophysical measurement equipment, nuclear radiation detectors, radiometers, and micrometeoroid detectors.

SATAR is sponsored by the Air Force Office of Aerospace Research as an addition to the existing Atlas contract. GD/A is contributing to the cost of the initial satellite, and there is a possibility of a substantial number of follow-on satellites in the program.

SATAR will measure 54 in. in overall length. The cylindrical center section measures about 27 in. in dia., and the hemispherical solar panel domes extend 12½ in. beyond the center section. This solar cell configuration will eliminate the need for hinging and packaging a flat solar cell panel configuration for stowage during launch. It also will eliminate the need for attitude control to point the solar cell panels toward the sun. SATAR will tumble randomly in orbit and rotate very slowly on its longitudinal axis.

Solar cell installation will be the most challenging requirement of the satellite configuration. Each solar panel will not weigh more than 12¼ lb. after mounting on a 3¾-lb. aluminum alloy substrate approximately 63 mils thick.

Solar cells will be blue N-on-P type (negative on positive semiconductors) silicon units measuring 1 by 2 cm. Cells will be expected to have a conversion efficiency about 10.5% AMO (air mass zero), including cover glass. This is considered a relatively high efficiency requirement and indicates that about 11% efficiency must be attained before adding optical filter to the cells.

Optical glass applied to individual solar cells will cover at least 95% of the cell active area and be 60 mils thick. The blue-reflecting coating adjacent to the solar cell faces will reflect the undesirable ultraviolet portion of the solar spectrum. This filter coating will have an average transmittance of less than 1% for wavelengths between 0.300 and 0.400 microns. For a wavelength of 0.450 ±0.015 the transmittance will be 50% and for wavelengths between 0.500 and 1.000 transmittance will be a minimum of 90%.

Average absorbance to solar radiation in 0.2 to 2.5-micron wavelength will not exceed 0.82. Average emittance of the solar cell top surface, with its glass cover, will not be less than 0.82 in the temperature range of 0 to 100C.

Solar panels will incorporate isolating diodes to prevent the cells from becoming a load to the remaining portion of the power generation system.

Cell arrangement on each panel will consist of 42 strings of 60 cells connected in series, but each group of 42 strings will be connected in parallel. Each group will use at least one isolation diode.

Conditions for testing the panels will include a tungsten light source at a color temperature of 2,800K, an illumination intensity in milliwatts/sq. cm., and a panel temperature of 28C. With light rays parallel to the longitudinal axis of the solar cell dome, the panel is expected to deliver not less than 22 w. at 25 v. and 880 milliamps. With the light rays normal to the longitudinal axis the panel will have to deliver not less than 17 w. at 25 v. and 680 milliamps.

In the 500 naut. mi. orbit, with an aspect ratio of 20%, minimum initial power delivered will have to be not less than 24.6 w. at 25.8 v. and 950 milliamps, when temperature is stabilized at 40C. Aspect ratio is the output of the solar panel seen at a specified angle versus the equivalent amount of panel required to give the same output when the light is normal to the panel. Under these same conditions, with 10% radiation damage after three months in orbit, minimum power delivered will have to be not less than 22 w., at 24 v. and 920 milliamps.

In orbit, the solar panel will be required to operate for 10,000 hr. while stabilized at a temperature within the range of 40F to 100F.

CONFIGURATION OF SATAR (satellite for aerospace research) is shown in sketch. SATAR is programed to be launched as piggyback unit on General Dynamics/Astronautics Atlas booster and injected into 500 naut. mi. orbit by additional thrust from the satellite's small jettisonable, solid propellant motor. The satellite's cylindrical center section will be capped with hemispherical solar panels. SATAR will tumble randomly in its orbital path. The satellite is sponsored by the Air Force Office of Aerospace Research.

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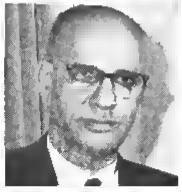

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BREGUET 941 STOL TRANSPORT is shown taking off in a test flight (left). Note extension of full span, double slotted flaps. Landing approach (right) is made with flaps fully extended for deflected slipstream effect. Maximum deflection of inner flaps is 100 deg.

Foreign Interest Revived in Breguet 941

By Warren C. Wetmore

Paris—Foreign and domestic interest in the Breguet 941 deflected slipstream STOL transport has been revived by the French government's recent $20 million supplementary budget request to begin production of the aircraft (AW June 24, p. 31).

Negotiations are under way with governments and private companies, and Breguet expects to announce the first orders for the aircraft before the end of 1963, according to Paul Gaillard, Breguet's commercial director.

Target date for starting production of the 941 is still undecided, Gaillard said. So is the status of a pressurized cargo/passenger version, designated the 942.

Breguet is discussing with French civil aviation officials the building of several 942 fuselages, which, along with associated landing gear and wing mounting structure, is the principal difference from the 941.

Production rate of the 941 has been tentatively set at two aircraft per month. Gaillard attributes this rather low figure to the company's desire for long-term production. This rate could be increased to a maximum of 3 to 4 aircraft per month if the demand is sufficient.

Current price quotation for either version of the aircraft is $1.3-$1.6 million. Cost of the 942's pressurized fuselage is offset by that of the 941's rear door and ramp.

These figures represent a substantial increase over the previously quoted price of $800,000 (AW June 12, 1961, p. 103), an increase, Gaillard said, due to growing costs of labor and materials. Compared with other aircraft, however, the latest price is only about 15% higher than conventional non-STOL airplanes in the same payload class, Gaillard said. Total expenditure on the program of $16 million is 80% funded by French government and 20% Breguet and associated contractors.

Production versions of the 941 and 942 will be powered by four Turbomeca Turmo 3D.3 free turbine turboprop engines rated at 1,480 shp. each, a gain of about 250 shp. per engine over the 941 prototype's Turmo 3Ds. The new engine has been bench-tested by Turbomeca and uses the same gas generator as the Turmo 3C.3 engine in the Sud Super Frelon heavy helicopter.

Br. 941 Specifications

Wingspan	76.7 ft
Length	77.9 ft
Height	30.7 ft
Wing area	897 sq. ft.
Mean aerodynamic chord	12.10 ft
Aspect ratio	6.53
Empty weight	28,920 lb.
Max. zero fuel weight	45,850 lb.
Max. takeoff weight	58,420 lb.
Max. landing weight	52,910 lb.
Max. fuel and oil	17,900 lb.
Max. speed	260 kt.
Cruise speed	215 kt.
Max. altitude	24,000 ft.
Normal altitude	10,000 ft.
Cargo hold:	
Length	26.6 ft.
Width	8.5 ft.
Height	7.4 ft.
Volume	2,330 cu. ft.

Mean time between overhaul (MTBO) is listed at 1,500 hr. and growth potential is estimated at over 500 shp.

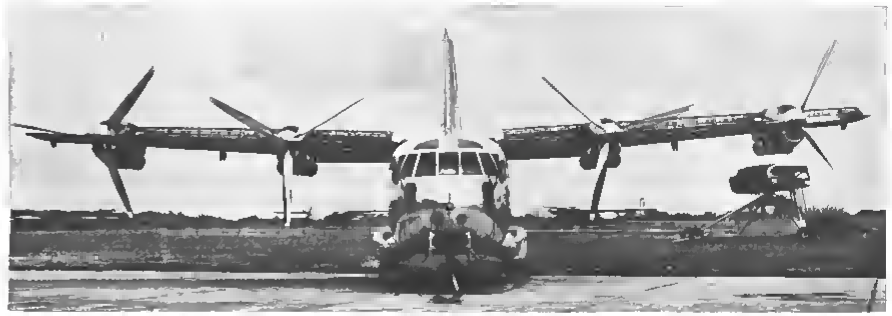
The two-stage free turbine is driven at 19,000 rpm. It, in turn, delivers power to a propeller shaft located above the turbine axis through a reduction gear—which lowers the rotation speed to 6,000 rpm.—and a transmission consisting of a free-wheel and a dog clutch unit.

A coaxial propeller reduction gear located just behind the propeller hub further reduces the shaft speed to the nominal propeller rate of 1,200 rpm.

Propeller interconnection—a safety innovation designed to prevent thrust asymmetry in the event of engine failure—is achieved with a flexible steel cross shaft developed by Hispano Suiza. The shaft extends the entire length of the leading edge between the two outboard engines.

The shaft is divided into four sections which are jointed at the bevel gear boxes behind the two inboard engines and clamped at a transmission box in the fuselage, which also contains the propeller pitch governor constant speed unit. The two outer rods are each 14.1 ft. long, while the inner rods—which bear the brunt of bending due to wing dihedral change under varying loads—are each 12.3 ft. long. The cross shaft passes through 18 stand-off bearings and the wing leading edges are removable for maintenance access.

In the event one engine fails, its propeller is powered by the remaining three engines through the cross shaft, with a thrust loss of about 17%. This is particularly important during STOL operation where asymmetric thrust



LEADING EDGE OF 941 wing is removable for cross-shaft maintenance. Mean time between overhaul for shaft system is about 1,500 hr., according to company. Breguet hopes to increase this to 3,000 hr.

could have disastrous consequences.

Propeller runaway is also prevented in this manner.

Conversely, one of the propellers can be feathered and its engine will continue to drive the three remaining propellers, entailing a 10% loss in thrust. Power loss in the cross shaft system is less than 1%.

The aircraft uses three-bladed variable pitch Breguet Ratier propellers with diameters of 14.76 ft. These give 4.4 lb. of thrust per horsepower and a cruise efficiency of 86%. The propeller system operates in three modes:

- **Constant speed mode,** employed during conventional cruise operation. The propeller pitch governor continuously adjusts common propeller pitch to maintain the desired rpm. The cross shaft also ensures absolute synchronization of all four propellers.
- **Differential pitch mode** supplementing control surfaces during STOL flight. Pitch of the two outboard propellers is differentially changed by movement of the pilot's stick. A left displacement increases the pitch—and therefore the thrust—of the outboard starboard propeller and correspondingly decreases that of the port outboard propeller, and vice-versa for a movement of the stick to the right. This action produces yaw and roll due to increased fan thrust on the outside of the turn and propeller slipstream deflection, respectively.
- **Transparency mode** permits approach slopes as high as 11.5 deg. during power-on landings. Outboard propeller pitch is symmetrically offset with respect to inboard propellers, reducing the blown slipstream on the outer wings to zero and boosting the inner-wing slipstream. This causes an increase in induced drag and thus steepens the flight path.
- **Reversal mode** is activated manually immediately after touchdown. It involves no change in the throttle setting and thus no delay.

The propeller pitch control system is basically a completely mechanical servo mechanism employing mechanical feedback. Inputs consisting of cross shaft speed—depending on the mode of operation—propeller reversal signal, differential pitch signal from the pilot's stick or offset signal during approach are mixed mechanically by differential gears on the pitch governor. Four mechanical outputs—one for each propeller—are routed to the proper pitch actuator by separate rotating shaft linkages and consist of angular displacements of these four shafts. Displacements are dissimilar in the differential pitch and approach (transparency) modes, and technical in the constant speed and reversal modes. Rotating shaft linkages are connected to the hydraulic pitch actuating mechanism by means of screw jacks.

Fuselage of the 941 is of conventional skin and-stringer construction and has a rectangular cross section.

Wing structure consists of three stiffened web spars covered on top and bottom by honeycomb sandwich panels to form torsion boxes. Airfoil designation is NACA 63A 416, distorted locally by the cambered leading edge. Integral fuel tanks situated within the torsion boxes have a maximum capacity of 2,642 U.S. gal. Leading edge slats are not used since Breguet found the camber to be equally effective for high lift.

Heart of Breguet's deflected slipstream approach to STOL lies in the large double slotted flaps with vanes which extend the entire length of the wing trailing edge. Maximum deflection of the inner flaps is 100 deg., and the outer flaps—which are also used as ailerons—can be extended to 70 deg.

This technique does not involve any

TWO LIGHT FRENCH ARMY trucks are driven into Br. 941 cargo hold. Aircraft's 16,500-lb. payload capacity permits carrying an armored car. Note airflow lufts on fuselage.

problems with downwash during engine run-up or ground run. Breguet claims. No ground erosion or exhaust recirculation has been observed.

Additional roll control is derived from the differentially-operated spoilers located on the upper surface of the wing forward of the outer flaps.

Torsion-box structure of the empennage is similar in construction to that of the wings. Control surfaces consist of a double rudder and conventional ailerons. In addition, the horizontal stabilizer is hydraulically adjustable to three pre-set positions for takeoff, cruise, and landing and it has an inverse-cambered leading edge to prevent flow separation during the STOL operation.

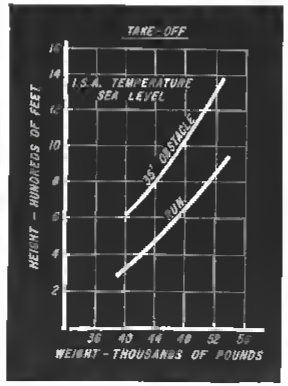
Flaps and all control surfaces are power-actuated by the 3,000 psi hydraulic system—which features two independent circuits—and operates off the inner bevel gearboxes. Also included in the system are artificial-feel devices fitted with force-trimming systems on all three axes.

The Messier-built landing gear is specially designed for rough-field operation and consists of a double-tired nose gear and tandem main gear.

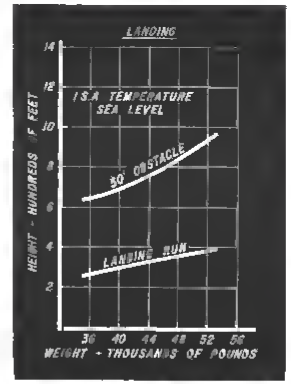
Wheel base is 23.6 ft and track is 11.8 ft.

Main gear wheels are mounted on rearward-swiveling struts connected to the same horizontal hydraulic cylinder, which functions as both a shock absorber and a retraction mechanism. Maximum stroke of the main gear is 23.4 in., and limit vertical velocity is 13.12 fps. Retraction is incomplete during flight the wheels protrude several inches below their faired housings.

Hydraulic cylinders for both nose and main gear also function as jacks, allowing changes of the aircraft's ground attitude to facilitate cargo handling.



BREGUET 941 TAKEOFF capabilities are shown in the above chart.

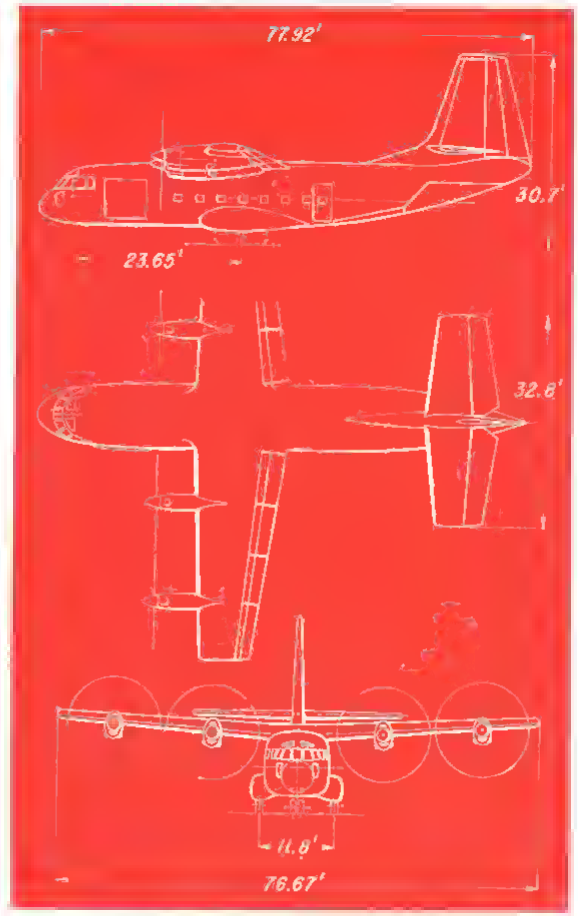


LANDING CHARACTERISTICS of the Breguet 941 are shown depicted in chart form

Breguet says the most extreme pitching moments in the STOL configuration have been trimmed in tests. The aircraft remains stable with a center of gravity displacement of 25.35% of the mean aerodynamic chord. Laterally, the Dutch roll mode is well damped. Onset of stall is gradual and is signalled by increasing buffeting. In the STOL configuration with the gear down, stall occurs at around 30 kt. Breguet says.

Operation of the Br.941 has been divided into three general missions:

- **Assault.** The aircraft can deploy 55 fully armed troops or an equivalent 6,600 lb. payload into an unprepared field close to a combat zone. Mission profile calls for a 270 naut. mi. radius without midpoint refueling. First 162 naut. mi. of the outbound leg is flown at 10,000 ft. and the remaining distance at 1,000 ft. Cruise speed at both altitudes is 215 kt. Return trip would follow the high-low pattern in reverse. Maximum initial takeoff weight is 44,000 lb., and mission-end landing weight—assuming that the aircraft returns with a 6,600-lb. payload—is 37,900 lb. Midpoint landing over a 50-ft. obstacle requires a distance of 705 ft. and midpoint takeoff a distance of 670 ft. to clear a 35-ft. obstacle.
- **Logistic support.** For this mission the Br.941 operates point-to-point over a 595 naut. mi. stage length with 15,650 lb. payload, at 10,000 ft. altitude, and at the normal cruise speed of 215 kt. Takeoff gross weight is 52,900 lb., resulting in a takeoff distance of 1,395 ft. to clear a 35-ft. obstacle. Landing weight is 46,500 lb., requiring 790 ft. with a 50-ft. obstacle.
- **Long range.** In missions that can be flown from prepared airfields, the aircraft will be able to haul 16,500 lb. a distance of 950 naut. mi. at 10,000 ft. cruise altitude and a 215 kt. cruise.



THREE-VIEW SHOWS dimensions and configuration of Breguet 941 STOL transport

speed. Takeoff gross weight is increased to 58,400 lb. and takeoff distance over 1,35 ft. obstacle to 1,750 ft.

Zero-payload ferry range is 1,600 naut. mi., which can be boosted to 2,700 naut. mi. by installing temporary additional tankage in the cargo hold.

Slow flight of the Br 941 in STOL configuration is very much like that of flying in a helicopter. During a recent demonstration at the French Air Force's Villacoublay Field near Paris, the Breguet pilot put the aircraft through a series of tight, well coordinated turns at approximately 65 kt. with no apparent instability or mushing. Maximum ceiling for slow flight in the STOL configuration is more than 10,000 ft.

Takeoffs and landings were comfortable despite the climbout and approach slopes. Touchdowns were gentle and deceleration of ½g during propeller reversal did not prove bothersome.

Takeoffs and landings were made diagonally across the runway. The aircraft's STOL capability is such that the pilot did not even align the aircraft with the center strip. For loading and offloading of passengers, the two port propellers were disengaged while their engines were left running, a feature which should permit rapid turnaround for the aircraft.

More than 250 hr. of flying time and

more than 500 takeoffs and landings have been logged by the 941 prototype to date. The company also has devoted considerable time to study of STOL landing techniques and touchdown point dispersion. In the latter, touchdown point was found to vary approximately ±90 ft. in a statistical sample of 50 landings performed by different pilots.

Landing approach slope selection is aided by a paravisual indicator in the cockpit. This device consists of three vertically arranged lights connected to a differential pressure angle of attack sensor located on the fuselage. Since the approach is made at an approximately constant angle of attack, the pilot can determine whether he is above, on or below the proper slope by noting which of the three lights is on.

Another landing aid which proved useful was a mirror system similar in principle to that used on aircraft carriers.

This technique reduced landing point dispersion to less than ±50 ft.

Only difficult part of pilot training for the Br.941 is likely to be the achievement of sufficient accuracy in landing plus the necessity for a conventionally qualified pilot to become accustomed to landing at 60% of maximum power.

Breguet feels that 25 landings should be adequate for conversion to the aircraft.

AFOSR Awards

Stanford Research Institute, Menlo Park, Calif.—$76,573 for incentive for scientists in various organizational contexts phase II-b.

Southwest Research Institute, San Antonio, Tex.—$33,750 for the study of nondestructive evaluation of metal fatigue.

Aeronautical Research Associates of Princeton, Princeton, N. J.—$24,868 for research on statistical mechanics of plasma flows.

General Electric Co., Philadelphia, Pa.—$54,664 for study of structural response to intrinsic electromagnetic radiation.

Callery Chemical Co., Callery, Pa.—$35,874 for continuation of research on N F compounds as calorimetric oxidizers. $32,748 for continuation of research on "interaction of helium ions with metallic surfaces."

Arthur D. Little, Inc., Cambridge, Mass.—$58,000 for the study of recirculation in liquid rocket engines.

Nordtronics Corp., Hawthorne, Calif.—$88,887 for research on plasma properties and momentum change.

Avco Everett Research Lab., Everett, Mass.—$356,984 for the study of plasma propulsion.

Arnold-Garrod Corp., Azusa, Calif.—$63,544 for research on pentaborane hydrazine reaction.

Plasmodyne Corp., Santa Ana, Calif.—$47,497 for continuation of rotary magnetohydrodynamics.

Atlantic Research Corp., Alexandria, Va.—$46,991 for investigation of high-pressure plasma production techniques.

Kirk Corp., Lexington, Mass.—$6,103 for research on the application of the galois connection to information systems.

The Budd Co., Long Island City, N. Y.—$13,228 for the study of pictorial data analysis concepts and techniques.

Indians Evaluate C-119G With Orpheus

Indian air force is evaluating performance of a Fairchild C-119G Flying Boxcar transport fitted with an auxiliary Bristol Siddeley Orpheus 701 turbojet engine mounted on the upper fuselage. The engine, which runs on 115/145 octane fuel from the aircraft's main system, provides 4,700 lb. thrust. The Orpheus installation was designed and fitted by Hindustan Aircraft, Ltd., of Bangalore, which builds the engine under license for the Folland Gnat trainers used by the Indian air force. India has used C-119s fitted with jet thrust augmentation in combat against Communist Chinese forces (AW Nov. 12, p. 127). Those aircraft had J34 jets mounted atop the center wing section. That modification was provided by Steward-Davis, Inc., Long Beach, Calif.

PRODUCTION BRIEFING

General Precision, Inc.'s Link Div. will build 15 T-26 flight trainers for Air Force under a $2-million contract. Simulators will be used to train pilots for Air Force's T-38 Talon aircraft, a two-place supersonic jet trainer.

Ross Corp. has received a $2.7-million contract to build a 214-ft. high tower at National Aeronautics and Space Administration's Michoud Operations Facility. Tower will serve as a vertical assembly, hydrostatic test and cleaning facility for the NASA-Boeing Saturn S-1C booster stage.

North American Aviation's Los Angeles Div. has received a $29,600 contract from National Aeronautics and Space Administration to build a crescent-shaped delta wing and 12 jet engine pods for wind tunnel tests of a 5-ft. supersonic transport model at speeds as high as Mach 3. North American now has 15 supersonic transport contracts.

American Bosch Arma Corp., Garden City, N. Y., has a $1-million contract from Air Force for additional Atlas missile guidance sets. Work will be done in Garden City.

Philco Corp., Palo Alto, Calif., has received a design study contract for a satellite control center for the U. S. Navy Astronautics Group, Pt. Mugu, Calif. Emphasis will be on the human operator functions in the system.

Garrett-AiResearch, Los Angeles, Calif., has received a $1.5-million contract from Air Force's Aeronautical Systems Div., for design and development of an engine analyzing system which will monitor turbojet performance during flight for subsequent evaluation by a ground crew. Six systems will be built for evaluation of J75 and J79 engines used in the F-105D and F-4C, respectively.

PneumoDynamics Corp.'s Cleveland Pneumatic Industries Div. will design and develop prototype blast valves for the environmental control system in Minuteman ICBM launch control facilities under a $1.5-million contract from Boeing Co. The blast valve will shut off the underground facility from the pressure of an above-ground explosion.

Allison Div., of General Motors, Indianapolis, Ind., has been selected by United Technology Center to provide pressurization and injectant tanks for the thrust vector control system of the Titan 3C space booster. The tanks, 42 in. in diameter and 33 ft. long, will be attached to each of the two strap-on solid propellant boosters which are attached to the sides of the Titan 3C core. Nitrogen under pressure will be used to force fluid into the exhaust stream for vector control.

Carrier Air Conditioning Co. has been awarded a $7.7-million Air Force contract to build and install environmental control systems for the Wing 5 Minuteman ICBM complex under construction at Francis E. Warren AFB, Wyo. The contract brings total funds obligated to Carrier for the Minuteman program to $23.6 million.

Arthur D. Little, Inc., will study solid propellant ignition for the Air Force Flight Test Center, Edwards Air Force Base, Calif. Objective of the one-year project is to develop methods for evaluating propellant igniter performance so that igniters and various propellants can be matched.

Communications Satellite Corp. is preparing requests for proposals on two or three parallel studies to investigate all potential modes of satellite communications. Contract awards are expected within the next few months. Comsat Corp. also plans to award study

U. S. Business & Utility Plane Shipments

(March 1963)

Make & Model	No. of Units	Net Billings
Aero Commander 500A & 560F & 680FP	4 3 4	$1 257 000
Beech Super 18 23 Musketeer 33 Debonair 35 Bonanza 50 Twin-Bonanza 95 Baron 65 Queen Air 80 Queen Air 65 Travel Air	4 93 10 16 3 15 2 6 2	$3 984 000
Cessna 150 172 Skyhawk P172 175 Skylark 180 182 Skylate 185 Skywagon 205 210 310 320 Skyknight	38 77 3 1 10 19 10 47 13 15 7	$4 589 000
Champion 7EC Traveler DeLuxe 7GCB Challenger 402 Lancer	1 2 4	$94 000
Mooney M-20C M-20D Master	40 2	$614 000
Piper PA 18-150 Super Cub PA-22 160 Colt PA 23 235 Apache PA-23-250 Aztec PA-24-180 Comanche PA-24 250 Comanche PA-25-150 Pawnee PA-25-235 Pawnee PA-28-150 Cherokee PA-28-160 Cherokee PA-28-180 Cherokee	11 24 11 21 3 28 4 40 4 3 63	$2 840,000
Totals	650	[illegible]

Note: This tally brings total shipments through March to 1,305 aircraft having a total net billing value of approximately $33,416,000 compared with 1,772 planes shipped in the same period last year having a total net billing of $35,423,000.

Contracts for several specific technical studies.

Raytheon Co., Lexington, Mass., has a $2.3-million contract for Hawk missile parts and components.

Navy Special Projects Office has issued a $7.4.2-million modification to an existing contract with Lockheed Missiles and Space Co., Sunnyvale, Calif., for continued R&D work on the Polaris missile. Previous commitments under this contract have totaled $170.7 million.

A. J. Industries, Inc., El Monte, Calif., will build 450-gal. drop tanks for Republic F-105 aircraft under a $2.4-million Air Force supplemental contract.

Belock Instrument Co., College Point, N.Y., has been awarded a $2.7-million Army contract for 25 Hawk missile training devices.

Avco Corp., Stratford, Conn., will build re-entry vehicles for the Air Force under a $1.3-million contract.

Emerson Electric Manufacturing Co., St. Louis, Mo., will build 120 helicopter armament systems under a $2.3-million Army contract. Work will be performed in St. Louis and Washington Park, Ill.

Sperry Rand Corp., Salt Lake City, Utah, has been awarded a $1.4-million contract for engineering services on the Sergeant missile program.

Missile Designations On Pocket-Size Card

New missile designations put into effect by the Defense Dept., together with the previous designations, have been reprinted from Aviation Week & Space Technology on a folding card.

Folded the card fits easily into a pocket, open, it can be affixed to a desk top. The cards are available from Aviation Week at 25 cents each for 1-20 copies, 20 cents each for quantities of 21-50, and 15 cents each in quantities over 50. Send orders to:

Aviation Week Reprint Dept.
330 West 42nd St.
New York 36, N.Y.

Test Duplication Cut With Data Exchange

By Barry Miller

El Segundo, Calif —Interservice Data Exchange Program (IDEP) a three-service effort to eliminate unnecessary duplication in component parts testing through the exchange of reliability data among missile and space contractors, currently is circulating about 6,000 recent test reports Between 300 and 400 new reports are entering its circulating bank each month

Now starting its fourth year of full scale activity IDEP has saved aerospace parts users time and money—conservatively estimated to run into many millions of dollars (AW Nov 6 1961, p 76 Jan 25 1960 p 67 Feb 13 1961 p 79)

Today participants in the program number about 130 of the nation's leading aerospace contractors situated at about 200 scattered facilities among which are almost all large defense and space users of avionic and associated parts according to Martin Barbe of Aerospace Corp here

Barbe an official in the Reliability Dept of Aerospace Corp has helped nurse IDEP to the point where it is emerging as a recognized factor in parts reliability

Reporting Procedure

In typical IDEP procedure a participating contractor forwards to one of three IDEP centers a copy of recently completed reliability or performance tests on particular components or parts Along with the report he includes a specially prepared summary

The report and its summary, received by the responsible center (Air Force's Ballistic Systems Space Systems Div the Army Missile Command or the Naval Ordnance Laboratory) are checked for legibility and consistency but not their technical accuracy The report is microfilmed and a microfilm copy attached to a photo-reproduced hard card copy of the summary

These are then distributed by the center to contractors in its geographic area, the delivery to the contractor following by ten days to two weeks initial receipt at the IDEP center

Simultaneously, a master copy is forwarded to the other two centers which distribute identical hard card summaries with the microfilmed report copies to contractors in their areas adding no more than another week or ten days time lapse

Individual reports encompass tests on parts ranging from components, like carbon film variable resistors, to more complex circuit assemblies like potted modules and microcircuits High reliability specifications also are included In fact of the 6,000 reports now in circulation about 1,000 are such high reliability specs Most of the reports are concerned with avionics parts

A report is regarded as current for only 20 months with the high reliability specifications being an exception to this rule Another 2,000 reports available through IDEP are over 20 months old hence are obsolete

Report Bank

IDEP's total bank covers roughly 11,000 items several thousand in excess of the number of reports since some reports deal with more than a single part Eventually, Barbe says he expects the number of current reports to level at about 8,000 to 9,000 embracing about 12,000 items

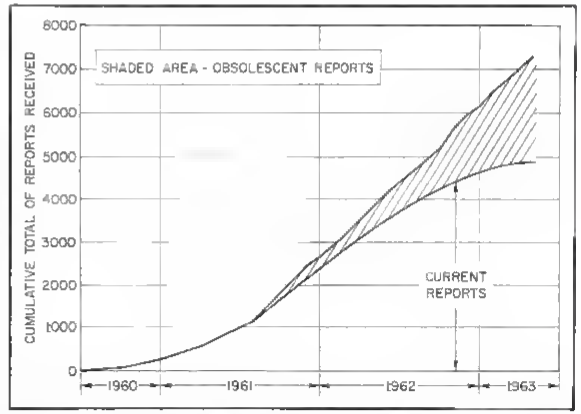
IDEP files contain four or more test reports on 500 types of parts Consequently, IDEP is weighing the possibility of preparing summaries of their summary cards as a separate standard report or trend sheet, itemizing all IDEP data on the given part

For example a typical summary-summary card on a particular carbon composition resistor might list the number of the referenced IDEP report the organization responsible for the test the number of items tested the date of the test, the environmental conditions of the test and comments or trends

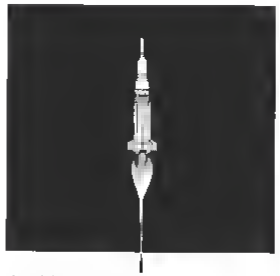
Engineer Comments

A government engineer, not contractor personnel would write the comments which on the basis of the indicated tests typically might advise against using a particular component under certain specified conditions Where conflict exists among test results on a particular component, the government engineer would not try to resolve it but would merely alert IDEP participants to its presence

A sore point arose early in IDEP operation when vendors sometimes objected to the circulation among potential users of unfavorable reports on their products, reports which they re



INTERSERVICE DATA EXCHANGE PROGRAM (IDEP), which is reducing unnecessary duplication of parts testing among government funded contractors and raising reliability by making existing data more generally available now has about 5,000 current test reports plus 1,000 high reliability specifications in its files Chart indicates growth over three years in the number of reports available and shows leveling due to obsolescence of the reports (those over 20 months old) Program reports cover all types of space and missile parts, but predominantly avionics parts. IDEP is becoming an acknowledged factor in data exchange and reliability.



immediate openings in

AEROBALLISTICS

Aerothermo Mechanics (aerodynamic testing, analysis, stability and cor lation, heat-transfer studies, thermodynamics of power systems and cryogenic storage and thermal research in theoretical gas dynamics, radiation physics and computer programs.) Flight Mechanics (trajectory analysis, optimization and simulation, guidance and control orbital and space rendezvous mechanics, evaluation of launch performance, launch and operation dynamics and celestial mechanics.)

FUTURE SYSTEMS ANALYSIS

Mission analysis and planning, operations research, advanced program planning, human factors.

ELECTRICAL and ELECTRONICS

Create, design and modify complex electrical and electron a assemblies and systems, perform load studies, circuit and system analyses, and logic diagram and switching networks. **Instrumentation, RF and Telemetry . . .** Missile flight measurements (airborne and ground instrumentation program, data and command flight measuring instruments) design and develop telemetering and RF equipment, test controls for checkout of flight hardware and digital circuits for guidance and control systems, blockhouse telemetry panels during final countdown, evaluate test results and originate necessary changes.

LAUNCH FACILITIES

Environmental control systems (launch facilities design including air conditioning systems, cryogenic piping and propellant storage.) Theoretical Launch Facilities Design (feasibility and design studies of future space flight systems—earth orbital and lunar base operations.)

MANUFACTURING

Analyze documentation, determine breakdown of assemblies, define operations, sequence and tool requirements, liaison in control product process, tool design and inventory. **Special Equipment Design . . .** Development design, analysis, construction and installation of special equipment, pneumatic and hydraulic, or electronic test equipment, special handling techniques in large components.

PROGRAMMERS

Analog Computation (structural dynamics, aero and astrodynamics, control and guidance systems and closed loop hardware simulation.) Digital Computation (information retrieval, data reduction, scientific computation in trajectory analysis, aerodynamic loading, structural and ablation analysis, aerodynamics.) Digital Programming to generate large scale data processing control system.

QUALITY CONTROL

Supervise and maintain retirement of standards in mechanical systems, electrical systems, quality assurance and systems automation, manuals, instructions and test procedures and develop techniques for adapting digital computers for automatic checkout systems.

RELIABILITY

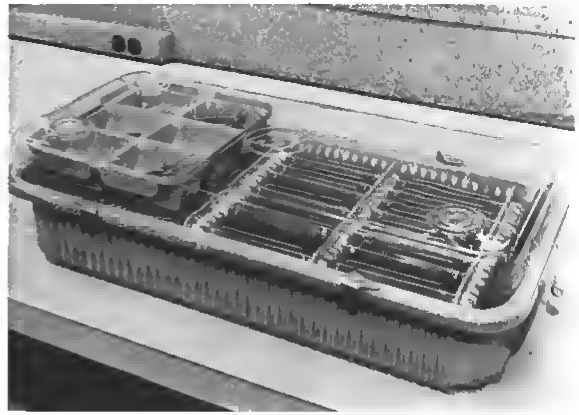
Develop analysis methods and techniques, analysis to electrical, mechanical, electro mechanical, structural, propellant, systems and other areas, evaluate program, recommend engineering changes.

STRUCTURAL, PROPULSION and RELATED ENGINEERING

Stress, structural dynamics, propulsion, cryogenics, aerodynamic loads, hydraulics, weights, materials, dynamic simulation, drafting, electro-mechanical component installation design and development of computer solutions for all phases of structural and mechanical analyses.

SYSTEMS INTEGRATION

Mission planning, functional integration, design criteria and mission evaluation of space vehicle systems and subsystems and digital automatic checkout equipment.



Container Holds Circuit Boards

Dust-free container holds avionic components and printed circuit boards during storage (above) in assembly operations (below). Designed by Martin Co., the containers come in two sizes with removable plastic partitions to accommodate a variety of items. Latches hold the transparent cover in place to keep out dust. Trays for small components are designed to hang from fixture on assembly bench. Containers are made 11 in. wide by 6½ in. high in 18 or 24 in. lengths.

garded as entirely or in part unjustified. Vendors often were not given a chance to review user test results and offer what might be valid comments or rebuttals before the reports were distributed by IDEP.

Now about 90% of IDEP participants are compelled by service contracting agencies to submit copies of their test reports to the manufacturers of the tested component, before they are sent to IDEP, not for censure but for comment. The vendor has two to three weeks to submit his comments on the report and these normally are appended to the user's test report.

Hence the same circulated report can present both sides of any disagreement on a parts test. At times, prompt response from the vendor has caused withdrawal of a report for retesting of parts.

About two years ago (AW Nov. 6, 1961, p. 76), IDEP began a program aimed at doing away with duplication in planning new tests, the so-called pre-IDEP or PIDEP program. Under PIDEP contractors submitted plans of contemplated tests so as to give other contractors an opportunity to scrap or modify their own duplicating efforts.

Barbe concedes PIDEP has not

Portable Checkout Equipment

Portable aircraft checkout equipment, housed in suitcase modules which can be set up and interconnected within 10 minutes, is suitable for flight line and maintenance depot use in trouble-shooting avionic systems. The high-speed digital equipment, developed by Emerson Electric Manufacturing Co operates from punched or magnetic tape instructions to control test sequence and evaluate test results All solid-state construction is used

worked satisfactorily Participants he explains, complained that test plans often changed after PIDEP reports were submitted

As a consequence IDEP has substituted an alternate plan to report on tests in progress (TIP) rather than both those in progress and those contemplated While TIP sacrifices two to six months of time ahead of commitment to test it still can eliminate duplicate tests planned by other contractors TIP also might alert a contractor simultaneously duplicating a test running elsewhere in sufficient time to reorient or stop his own test efforts

For each part to be tested, a contractor submits a TIP sheet similar in form to the standard IDEP test summary card Should the test be canceled rescheduled or changed, the contractor then files another TIP sheet which like the original IDEP circulates among its participants

Success or failure of a contractor's participation in IDEP rests largely with the individual coordinator responsible for submitting test reports and handling IDEP affairs If the coordinator is a live wire, IDEP usually has been a success at the facility

Partly as a measure of the recognition the program has gained, IDEP coordinator is becoming a recognized position in government contractor facilities It is not uncommon, Barbe says for an IDEP coordinator at one company to switch to that position at another company

IDEP encourages coordinators to consult one another and discuss mutual IDEP problems Recently, the first of what is planned as a series of annual meetings of all IDEP coordinators was held in Dallas at the initiative of industry representatives

Their purpose was to organize contractors views, to discuss common problems and to supply IDEP data centers with needed feedback on the operation A contractor-governed steering group is being organized to funnel back industry comments to IDEP centers to maintain liaison with parts suppliers and to jointly shoulder necessary tasks not funded in IDEP

Barbe has assembled a mass of letters and statistics to back up his claim that IDEP has saved government contractors many millions of dollars Several specific cases with estimated dollar savings for each, assembled earlier in the program were cited previously (AW Nov 6, 1961 p 76)

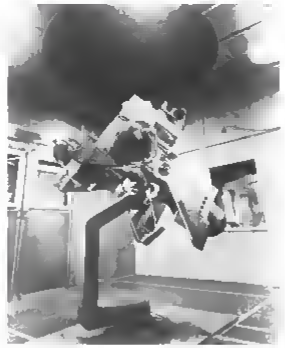
A more recent sample is one of many letters, this one from a large aerospace manufacturer Among the quantitative and qualitative savings attributed to IDEP it lists

- Cancellation of various tests on printed circuit connectors fixed resistors rack and panel connectors solid tantalum and glass capacitors and various materials at a total savings of $35,000
- Shortening of tests on trimmer resistors and relays after a review of available IDEP reports, providing $4,300 in savings
- Easier selection of relay vendors and reduction in the number of trips by its personnel to potential materials suppliers

Besides IDEP contributions to service contractors, data generated by centers of National Aeronautics and Space Administration is feeding into the program

Additionally, IDEP data currently is being used by Astro Reliability Corp., a Sherman Oaks Calif. consulting and reliability service group, in support of a NASA program Astro Reliability is using IDEP data to establish environmental qualifications capabilities of parts to perform on specific missions of NASA interest

Every other month IDEP issues to



Motion Simulator

Satellite motion simulator weighing 1,500 lb., attached to 12-inch steel ball, floats on cushion of air at Westinghouse Defense Center where it is used to test attitude control jets and infrared horizon sensors. Black circular dish overhead is heated to 150F to simulate appearance of earth to sensors.

participating contractors a listing of IDLP reports, which combined with an earlier companion volume, comprise an index of all distributed IDEP documents— PIDEP reports, current reports, industry standards and inactive reports.

They are itemized within parts type with vendor, vendor part number, standard part number and data all indicated. Coded information provides details of the part, its principal of operation, material, characteristics.

There appears to be a possibility that a government agency may reduce IDEP data to a tape form suitable as an initial step toward setting up a system for automatic machine retrieval of available IDEP information.

IDEP has grown in parallel and in cooperation with the Navy's Guided Missile Data Exchange Program (GMDEP) sponsored by the Bureau of Weapons. The two work closely, many of their procedures being identical and their data exchanged so that IDEP reports embrace those generated by GMDEP contractors.

Participants in IDEP generally are government funded contractors, whose tests would be of value to other government sponsored activities. The funding agency rules on the acceptability of each participant.

The Armed Services Technical Information Agency (ASTIA) began publishing late last year in its Technical Abstracts an abbreviated form of IDEP summary cards on selected tests. The ASTIA reports are not made available as quickly as are the original summaries.

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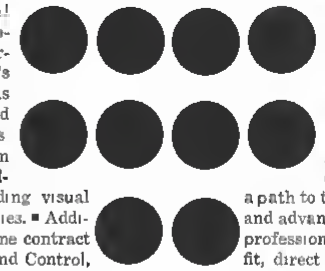

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ELECTRONICS Should have rigorous background in the logical design of special purpose digital computers for aircraft or space vehicle applications.

SYSTEMS Past professional experience should encompass the systems design of space or airborne systems utilizing analog and/or digital computers.

RELIABILITY Responsibilities will involve creation of reliability portions of proposals, analysis of designs on active contracts and preparation of reliability estimates.

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LETTERS

Cooper Sightings

In your story of the MA 9 flight (AW May 27, pp 25, 26) you reported that Astronaut Cooper said that he could observe objects as small as a truck on a highway from his capsule I find this difficult to believe

If we assume an altitude of 100 mi and a house on the ground that is 30 ft square we find that the angle subtended by the house to an observer at that altitude to be an order of magnitude smaller than the 1 mm of arc generally taken as the limit of average resolving power In short, either Maj Cooper has visual acuity worthy of a separate study in itself or he was making a good case for a manned reconnaissance satellite In no story of this flight have I seen reference to any optical aids on board, so I must regretfully conclude that these observations were hallucinations Could NASA's medical men clear up the confusion for us?

HERBERT DUNKERLEY
Schenectady, N Y

(As Reader Dunkerley indicates there is considerable skepticism over Maj Cooper's report of distinguishing small objects from his capsule (AW June 17 p 34 July 1, p 31) However, the official NASA viewpoint is that Cooper was the first U S pilot to fly in space on a clear day, and there is no baseline data from other U S Mercury flights for direct comparison Consequently, the agency is withholding judgment on whether or not Maj Cooper was having hallucinations until additional flights are made Meanwhile both astronomers and biomedical specialists are making measurements in attempts to develop theory which might explain this report—Ed)

The remarks of Dr W R Adey (AW June 17, p 34) to the effect that it was absolutely impossible for Astronaut Cooper "to see a 10 ft dia object from an altitude of 500 000 ft" are wide open to challenge For example, I—a far-sighted individual—have often been able to distinguish 016 wires at over 300 yd, and millions of quite ordinary human beings have clearly seen 15 ft Sputniks at over 200 mi Both achievements involve the perception of objects at a distance of roughly 1 000,000 times their diameter The wire sightings, a lower contrast situation than that for the satellites, were made easier by their length

By comparison, Cooper's houses, smoke blobs, and boat wakes were easy targets at 1 dia x 50,000

Only the quartz capsule window and the equivalent of 4 or 5 mi of smog-free sea level air were between the astronaut's eyes and the earth The human eye has ingenious methods of perceiving objects whose retinal images are smaller than the eye's receptors, and Dr Adey would do well to recheck his basic assumptions regarding resolution before further deprecating Gordo's reports

FARNELL SCHOENKY
Kirkwood Mo

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

Supersonic Blues

Sing the supersonic blues,
Someone's always making news
"Prestige is paramount," they say,
"To get it means we need Mach Trey"

Don't be swayed by current art,
Climb aboard the apple cart!
Of super alloys, wrought and cast,
Titanium and fiberglass!"

"Beryllium is just the deal,
And then there's always stainless steel
It may take time and lots of luck,
And at least one kilo mega-buck!"

Aluminum is dead and gone
Forty million Frenchmen must be wrong!
Why be first, it's just a habit
Not the tortoise, be the rabbit!"

But now young Jack has set us straight,
With words of wisdom, said of late,
"I promise, not the boat to rock
You pays your money, and picks your Mach!"

L W MAYER
P O Box 1012
New Kensington Pa

Moon Battle

Your editorial gives a name to $40 billion moon program opponents Carping Bushwhackers The big debate is now shaping up it is Carping Bushwhackers vs Moondogglers

One reason why there is more heat than light coming from this debate is the intelligence-insulating arguments coming from some nationally prominent moondoggers They talk of the moon in the way a mountain climber talks of Mt Everest "It is there" They talk of how this $40 billion will boost the economy as if some other effect would result from spending it on schools, vocational training for the unemployed supersonic plane development, helicopter and VTOL research, water desalting research, or more support for Vietnam A few of them even try to relate sending people to Planet X or Cloud 9 to the overpopulation problem

History has not been kind to peoples whose leaders have lost touch with reality It is childish to have space-age mirrors on the wall to tell us we are fairest of them all It is dangerous to go to witches as Macbeth did to be told signs of invincibility We want no future Shakespeare to write

Double double, toil and trouble.
Fire burn, and cauldron bubble
Cool it with some baboon's blood
Then the charm is firm and good.
Stu in some Canaveral fire—
See! The Apparition's higher
Now we know our trouble's banished!
Now we see our foes all vanquished!

There must be some more practical and rational reasons for spending all this money in this particular way Let's have them!
—Carping Bushwhacker

W H RASEN
6451 W 83rd St
Los Angeles 45, Calif.

TFX Coverage

Your Letters page of June 3 indicates that some readers actually oppose the TFX, et al investigations and your coverage thereof, one even adds the interesting estimate of the amount of money to be saved through commonality in aircraft i.e., terrific'

My vote is one of thanks for the full measure of reporting on these matters It appears to me to be truthful reporting, since in regularly reading three independent newspapers a similar (though less detailed) picture of irresponsible civilian federal administrators is painted

It is amazing that the federal executive branch of government can so fully support such appointees

So it is additionally fortunate if your editorials tend to support Senator McClellan, Congressman Moss and their colleagues who hopefully are going to ensure that the balancing power of the federal legislative branch of government remains a power as the Constitution intended

SAMUEL H BASSETT
P O Box 333
Pacific Palisades, Calif

FJ-4B Error

Aviation Week is one of the finest publications in the industry I have found its articles, editorials and pictorial coverage of the news almost without question

However, I must beg to differ with the caption on the picture, p 39 of the June 17, 1963, issue

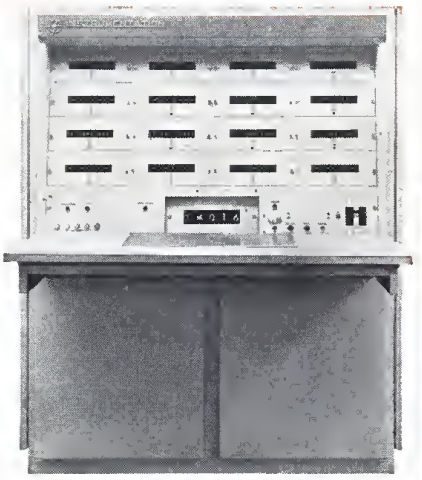
This photograph shows a Shrike air-to-surface missile suspended from a pylon under the wing of a Navy aircraft Your caption states this is on a Douglas A4D Skyhawk, which, unfortunately, is not correct Close examination of the leading edge of the wing, wing fence, vortex generators around the tail pipe and the horizontal stabilizer configuration clearly shows this aircraft to be an FJ-4B

Having spent a considerable number of pleasurable hours in the A4D before leaving the service I find it difficult even now to confuse the two aircraft

ROBERT W DRISCOLL
Lt (USN) Ret
10 Canton Rd
Simsbury, Conn

(Reader Driscoll is right—Ed)

Why spend your R&D budget designing test equipment when you have all this to choose from?

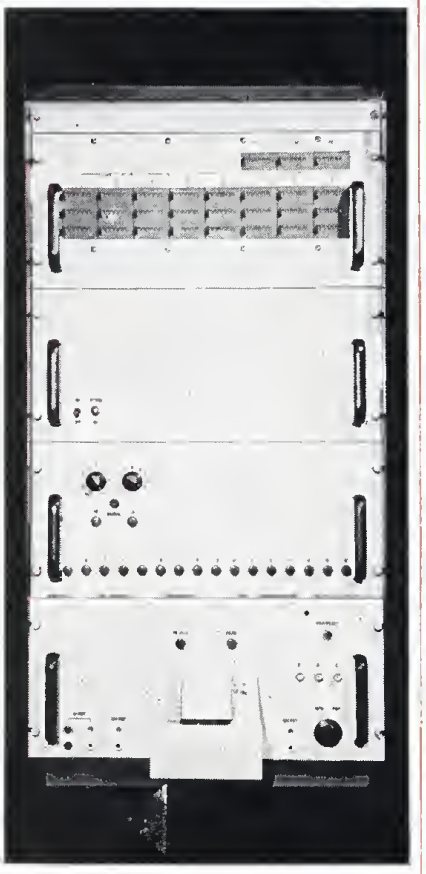


Series 500 Multiparameter Semiconductor Tester. Rapid programming, automatic direct digital readout. Pulse testing. Data logging optional. Can be run by relatively unskilled personnel.

Series 3500 (not pictured). The CAPACITRAN for high speed, automatic test measurements of capacitors by unskilled personnel. Direct digital readout and/or high-low limit programmable indication. High accuracy.

Model 20 Low Current Leakage Tester for semiconductors. Fast, easy go/no-go operation with pass-reject lights or absolute readout. Noise shielded for high accuracy.

Series 900 Card Programmed Semiconductor Data Logger (not pictured). Up to 24 tests in any order. Self-checking. Visual digital readout. Test results available on punched cards, punched tape or automatic typewriter.



Series 250 Go/no-go tester for semiconductors. Allows unskilled worker to test up to 900 units per hour—16 variable go/no go tests per unit. Pulse testing. Classification chassis for priority sorting available.

Model 50 Pulsed direct reading Beta Tester. Three digit visual display. Two seconds maximum per unit with 2% accuracy. For economical 100% incoming inspection or engineering evaluation. Pulse testing.

Series 100 Diode Sorter and **Series 200** Transistor Sorter (not pictured). High speed multiparameter testing for manufacturing and incoming inspection. Punched card programming. Automatic priority sorting. Handles 3600 diodes or 1500 transistors per hour.

Fairchild developed these instruments for its own use—and to its own manufacturing standards. Now, with accuracy and reliability proven by extensive in-factory application by Fairchild and many other customers, they're available to you. Write for information on the full line of Fairchild test equipment.

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